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ATOMIC ENERGY LEVELS

As Derived From the Analyses
of Optical Spectra

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Author's Note on the Reprinting of
Atomic Energy Levels: Volume I, 1949; Volume II,
1952; Volume III, 1958, Circular National Bureau of Standards 467

Although twelve years have elapsed since the publication of Volume III, there is a continuing steady demand for these Volumes. The data they contain on atomic spectra cover all elements in the Periodic Table except the two groups of rare-earths: the lanthanides ($Z = 58$–71) and the actinides ($Z = 90$–$?$). Similar data for these spectra will be handled in a forthcoming Volume IV, now in course of preparation by W. C. Martin and his colleagues.

One of the rewarding aspects of these compilations has been the stimulation they have provided to further research on the analyses of atomic spectra. Gaps in the knowledge of spectra, and needs for investigation of additional spectra are immediately apparent in this comprehensive compendium.

Many additional spectra have been studied and numerous extended analyses have been published that supersede the material contained in Circular 467. A bibliography in the National Bureau of Standards Special Publication 306, Sections 1 to 4 (1968–1969), provides later reference material on individual spectra. It will be some years, however, before the entire set of Volumes will be superseded. The existing supply of these books is low. In order to meet the steady flow of requests, it has been decided to reissue the three Volumes as part of the National Standard Reference Data System. They are reprinted here as NSRDS–NBS 35, Volumes I, II, III.

The first Volume, issued in 1952, is in great demand, and more seriously in need of extensive revision than are the others. As new analyses appear for spectra of the lighter elements, the lists of revised energy levels, together with revised Multiplet Tables, are being published by the National Bureau of Standards under the title "Selected Tables of Atomic Spectra, Atomic Energy Levels and Multiplet Tables," as Sections of NSRDS–NBS 3. Section 1 contains these data for the spectra Si II, Si III, Si IV; Section 2 for Si I; Section 3 for C I, C II, C III, C IV, C V, C VI. Similar data on the nitrogen spectra of higher ionization will be presented in Section 4. A number of other spectra are partially completed for inclusion in this Series.

Wherever the individual spectra in Volume I have been revised and reported in the NSRDS–NBS 3 Series, indication of this fact is clearly stated for each spectrum, in this reprinted issue.† Readers are urged to use the revised material for the spectra thus marked and to take note of further revisions of selected spectra as they appear in this series.

Washington, D.C.
November 30, 1970

Charlotte E. Moore

Abstract

ATOMIC ENERGY LEVELS, VOLUME I. ¹H to ²³V

This series of three volumes is a critical compilation of atomic energy levels prepared at the National Bureau of Standards from the analyses of optical spectra. Volume I contains data on the spectra of hydrogen, deuterium, tritium, helium, lithium, beryllium, boron, carbon, nitrogen, oxygen, fluorine, neon, sodium, magnesium, aluminum, silicon, phosphorus, sulfur, chlorine, argon, potassium, calcium, scandium, titanium, and vanadium (^{1}H to ^{23}V). Volume II covers the spectra of chromium, manganese, iron, cobalt, nickel, copper, zinc, gallium, germanium, arsenic, selenium, bromine, krypton, rubidium, strontium, yttrium, zirconium, and niobium (^{24}Cr to ^{41}Nb). Volume III includes the spectra of molybdenum, technetium, ruthenium, rhodium, palladium, silver, cadmium, indium, tin, antimony, tellurium, iodine, xenon, cesium, barium, lanthanum; hafnium, tantalum, tungsten, rhenium, osmium, iridium, platinum, gold, mercury, thallium, lead, bismuth, polonium, radon, radium, and actinium (^{42}Mo to ^{57}La; ^{72}Hf to ^{89}Ac).

Key words: Energy levels; H–V.

†EDITORIAL NOTE: See revision note on pages 21, 24, 26, 29, 30, 31, 144, 147, 148, and 150, Volume I.

ATOMIC ENERGY LEVELS

As Derived From the Analyses of Optical Spectra

Volume I

The Spectra of Hydrogen, Deuterium, Tritium, Helium,
Lithium, Beryllium, Boron, Carbon, Nitrogen, Oxygen,
Fluorine, Neon, Sodium, Magnesium, Aluminum, Silicon,
Phosphorus, Sulfur, Chlorine, Argon, Potassium, Calcium
Scandium, Titanium, and Vanadium

BY CHARLOTTE E. MOORE

Preface

The present volume is the first of a series being prepared at the National Bureau of Standards as part of a general program on atomic energy levels derived from observations of optical spectra. This program can be traced back to 1924 when the Division of Physical Sciences of the National Research Council created a Committee on Line Spectra of the Elements. The general plan was to encourage and contribute to the structural analysis of atomic spectra and eventually to publish the results in a series of monographs. For twenty years the lure of complex spectra gave emphasis to analysis rather than to compilation and publication of Committee Reports.

In 1932 an extremely timely and useful book entitled "Atomic Energy States as Derived from the Analyses of Optical Spectra" was published by Robert F. Bacher and Samuel Goudsmit. That book set a precedent for omitting experimental details (wavelengths, intensities, Zeeman patterns, etc.) and summarized the terms then known for 231 spectra of 69 elements. Now structure has been recognized in more than 460 spectra, representing 83 elements, and the earlier analyses have in almost all cases been greatly extended.

The accumulation of spectroscopic data is now too vast for publication in a reasonable number of monographs, but the energy levels derived from them are so important for physics, chemistry, and astronomy that a revision of "Bacher and Goudsmit" is urgently needed; it can probably be condensed into three or four volumes. In the spring of 1946 it was determined that neither Bacher nor Goudsmit contemplated such a revision, and it was decided to undertake this at the National Bureau of Standards. Details of this project were discussed at a meeting of the National Research Council Committee on Line Spectra of the Elements, called by the Chairman, Henry Norris Russell, and held in Washington in May 1946. It was then decided to send to interested workers in various fields a questionnaire regarding the most useful form of presentation of the data on atomic energy levels. The present form represents the majority vote resulting from that inquiry.

It was originally planned to issue sections in pamphlet form as the manuscript was completed, and to assemble the sections into volumes of about 400 pages each. Section 1 has been published separately.

This volume comprises the first three sections of Circular 467 of the National Bureau of Standards as follows:

Section 1. The Spectra of Hydrogen, Deuterium, Tritium, Helium, Lithium, Beryllium, Boron, Carbon, Nitrogen, Oxygen, and Fluorine. (Pages 1 to 75.)

Section 2. The Spectra of Neon, Sodium, Magnesium, Aluminum, Silicon, Phosphorus, Sulfur, and Chlorine. (Pages 76 to 210.)

Section 3. The Spectra of Argon, Potassium, Calcium, Scandium, Titanium, and Vanadium. (Pages 211 to 309.)

It has since been decided not to publish sections 2 and 3 separately because they are simultaneously in press and complete Volume I.

The manuscript has been prepared by Charlotte E. Moore under the direction of William F. Meggers, Chief of the Spectroscopy Section of the Atomic and Molecular Physics Division. Sincere appreciation is hereby expressed for the cordial cooperation of the National Research Council Committee on Line Spectra of the Elements, and for the heretofore unpublished contributions of many spectroscopists. Because the current volumes of Atomic Energy Levels disclose many gaps in our knowledge in addition to some uncertainties and occasional irregularities, it seems certain that they will inspire further researches in experimental and theoretical spectroscopy, and thus in turn advance the specialized subjects of atomic and nuclear physics.

E. U. CONDON, *Director.*

WASHINGTON, D. C., June 1948.

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1. Introduction

Since the publication in 1932 by Bacher and Goudsmit of their book "Atomic Energy States," [1] the number of energy levels determined from the analyses of optical spectra has increased by a factor of perhaps 4 or 5 and yet no critical compendium of these data exists. In order to meet this need, the present compilation has been undertaken at the National Bureau of Standards.

A handbook of "Atomic Energy Levels" is an indispensable tool for workers in many fields of science today. For the spectroscopist it reveals the gaps in our knowledge of atomic spectra—both those spectra that are incompletely analyzed because of insufficient observations and those that have not yet been observed. For the theoretical as well as the experimental investigators, the detailed comparison of data on related spectra, uniformly arranged, is a useful guide in the study of series, intervals, electron configurations, and many other related problems of atomic structure.

Many interesting spectroscopic problems also arise in connection with microwave spectroscopy, with ultraviolet solar spectra observed from rockets, with infrared spectra observed with a sensitive detector, and in general with types of observation that have developed comparatively recently. If the analysis of a spectrum is complete the positions of the lines can be calculated from the known energy levels, including in many cases those of lines in the far infrared or ultraviolet. The present term tables are now being used in connection with some problems of this sort.

The needs of the nuclear as well as the atomic physicist, of the chemist interested in atomic structure, of the astrophysicist interested in the study of stellar structure and cosmical abundances, and of those in many other fields of science all provide the inspiration for this work.

2. Scope of the Present Tables

Ten of the fourteen members of the National Research Council Committee on Line Spectra of the Elements attended the meeting held in Washington in May 1946, to consider details of this program. Two members who were unable to attend, I. S. Bowen and R. A. Sawyer, made personal visits to the Bureau before the meeting for this purpose. A number of other spectroscopists, including B. Edlén, have also been consulted in private conference.

On the recommendation of the committee a questionnaire regarding details of arrangement of the tables was sent to 94 interested workers in various fields of science. Sixty-one replied to this inquiry. The scope, uses, and format of the book have been discussed at length and the general form adopted is a direct outgrowth of these conferences and recommendations.

The cordial collaboration of those who have been contacted is gratifying. The Chairman of the Committee, H. N. Russell, has read all of the manuscript, provided much material, and made many helpful suggestions. The writer has had the benefit of his broad experience with spectroscopic problems. The committee and others as well are giving their wholehearted support to this program.

Requests to extend the scope of the tables have been seriously considered. It was finally decided to include only the energy levels derived from observations of atomic spectra, exclusive of hyperfine structure ascribed to atomic nuclei (with the exception of H, D). With full appreciation of the importance of critical data on nuclear and X-ray spectra, on isotopes, and on other subjects related to atomic structure the present policy was adopted for several reasons. The usefulness of the tables might well be vitiated by the inclusion of too many kinds of data. The critical editing of the enormous amount of literature entailed by extending the program would of necessity delay by years the publication of data on any one phase of the subject. Finally, the preparation of the volumes of "Atomic Energy Levels" is an appropriate sequel to the work on the revised edition of "A Multiplet Table of Astrophysical Interest," [2] hereinafter referred to as RMT.[3] These two types of tables used in conjunction with each other provide a condensed and unified picture of many atomic spectra—the one containing the energy levels and term designations used to compile the multiplets and excitation potentials recorded in the other.

In view of the limitations imposed here, reference is made under the relevant spectra to the excellent summary and bibliography of data on hyperfine structure by Meggers, in his paper entitled "Spectroscopy, Past, Present, and Future." [4] In addition, selected later papers on hyperfine structure and isotope shifts are listed for certain spectra. The reader is warned, however, that the individual references on these subjects included here are highly selected and that the present book is inadequate for workers in these fields.

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[1] McGraw-Hill Book Co., Inc., New York, N. Y., and London (1932).

[2] Princeton Univ. Obs. Contr. No. 20 (1945).
[3] This edition is limited to lines of wavelength longer than 3000 A. Along with the tabulation of energy levels, the writer is also preparing an ultraviolet extension to the Revised Multiplet Table.
[4] J. Opt. Soc. Am. **36**, 431 (1946).

3. Nomenclature

(Atomic Energy Levels, Spectroscopic Terms, Multiplets)

Briefly summarized, the atoms of a gas or vapor, when excited by radiation, absorb certain wavelengths corresponding to transitions of their outer electrons from lower energy levels to higher ones. When the transitions are from higher to lower energy levels the lines are emitted. Each chemical element can emit as many atomic spectra as it has electrons. If, for example, a sample of pure vanadium is placed in an electric arc and light from the arc is observed through a spectroscope, a complex array of spectral lines of various intensities appears. Most of these lines are produced by neutral vanadium atoms and are characteristic of the first (or arc) spectrum of vanadium, Vi.

If vanadium atoms are excited by an electric spark instead of an arc the higher energy of the spark will cause a large proportion of them to lose an electron. The atoms with one less electron in turn exhibit their own characteristic array of spectral lines, i. e., the second spectrum of vanadium, Vii. Similarly, with suitable sources of excitation, spectra of higher ionization can be observed corresponding to the loss of 2, 3, etc., electrons, the total number possible being equal to the atomic number of the element in question, in the case of vanadium, 23. To date, however, nothing is known about the vanadium spectra beyond Vxiv. The present volume contains the energy levels of all atomic and ionic spectra in which structure has been recognized, for the 23 chemical elements hydrogen through vanadium, H, Hei, Heii, Lii, . . . Vxiv, and includes 206 spectra.

The wavelengths, or positions of the lines observed in a given spectrum are carefully measured, and estimated intensities of the lines recorded. The *wavelengths* are then converted into *wave numbers in vacuo* from standard tables.[5] By studying differences among the *wave numbers* of the observed lines the *energy levels* can be found, since each spectral line is produced by a transition between two such *levels*. From a careful study of groups of lines that have similar characteristics, such as intensity behavior when produced at different temperatures in the laboratory, the levels involved in the production of the lines are grouped to form spectroscopic *terms*. The terms result from definite configurations and motions of the outer electrons of the atom and are explained by a well-established theory of spectral structure.[6] For any given electron configuration the array of terms to be expected in a given spectrum can be predicted from the quantum theory. Conversely, the energy levels and the terms formed from them furnish fundamental information, based on observation, concerning the outer electrons of the atom. The energy levels are, therefore, important constants of nature.

A group of related lines produced by transitions between two complex terms was first called a *multiplet* by M. A. Catalán in 1922.[7] The Multiplet Tables mentioned above (RMT, sec. 2) give the observed wavelengths of the lines that form the leading multiplets of many different spectra.

4. Arrangement

An attempt has been made to follow the general plan adopted by Bacher and Goudsmit in 1932, but some major changes have been introduced. In the present work the elements are arranged in order of increasing atomic number rather than in the alphabetical order of their chemical symbols. The tables on pages xl and xli should facilitate cross reference to the earlier book. For a given element the arc spectrum is followed by the successive spark spectra in order of increasing stage of ionization, as was done previously. Gaps occurring in the run of spark spectra for a given element indicate that structure has not yet been recognized in the missing spectrum.

Contrary to the earlier arrangement, in the present compilation the energy levels of *all* spectra are listed upward from the ground state *zero*. Absolute values are not given, but can be found for series spectra by consulting the references to the analysis or by subtracting the tabulated values from the limit quoted for a given spectrum.

4.1. Headings, Remarks

For each spectrum descriptive remarks which are self-explanatory, are preceded by headings as follows: Those on the left give (1) the number of electrons in the atom, and, except for arc spectra, the isoelectronic sequence to which the spectrum belongs (see sec. 8.4); (2) the ground state of the atom with its complete electron configuration; (3) the absolute value of the ground level in cm^{-1}, i. e., the limit referred to the ground state of the ion of next higher ionization. The headings on the right give (1) the atomic number Z and (2) the ionization potential in electron volts obtained by multiplying the limit quoted

[5] H. Kayser, *Tabelle der Schwingungszahlen*, Revised Edition (Edwards Brothers, Inc., Ann Arbor, Mich., 1944).

[6] F. Hund, *Linienspektren und Periodisches System der Elemente* (Julius Springer, Berlin, 1927).

[7] Phil. Trans. Roy. Soc. London (A) **223,**, 127 (1922); Rev. Acad. Madrid **25,** 20 (1922).

on the left by the factor 0.00012395, which was recommended by Birge in 1941.[8] [9]

In the remarks the word "author" refers to the investigator who has worked on the analysis of the spectrum, in contrast to the word "writer," which applies to the present compiler of these data.

4.2. References

In 1914 W. F. Meggers started a card catalog of all literature references on the description and analysis of atomic spectra, which has been carefully kept up to date and is doubtless the most complete of its kind in existence today. This catalog, together with the valuable and extensive collection of spectroscopic reprints of Meggers and Kiess, furnish the basic material requisite to the present program.

Following the descriptive remarks, literature references are given for each spectrum. It is not the purpose of this book to list all references to the analysis of each spectrum. The writer has attempted to make a careful appraisal of the literature and to list all the references needed to cover the complete analysis, including, of course, those used in the present work, and those giving the classified lines, energy or Grotrian diagrams, and observed *g*-values. A few selected references to hyperfine structure and isotope shift are also included, as mentioned in sec. 2.

In many spectra important regularities have been found by an author whose name does not appear in the references quoted here. This occurs when later and more complete papers include the earlier results and references. For example, Bowen and Millikan first discussed a number of the spectra described in Edlén's Monograph,[10] but only the later reference is listed. Full recognition should be given to all such contributors in spite of the arbitrary limitations imposed here.

4.3 Reference Symbols

Most of the literature references are followed by letters in parentheses, which describe the scope and content of the paper, as follows:

I P	Ionization potential.
T	Terms.
C L	Classified lines.
G D	Grotrian diagram.
E D	Energy diagram.
Z E	Zeeman effect.
I S	Isotope shift.
hfs	Hyperfine structure.

Several of these topics are frequently discussed in one paper, in which case all the symbols that are applicable are mentioned with the reference. If, for example, the symbols (I P) (T) (C L) follow a reference, it signifies that the paper gives an ionization potential, terms, and classified lines.

In a few selected cases, self-explanatory descriptions follow the reference, as, for example, in C I "(Solar data)."

Some papers are described in abstracts or letters to the editor in the Physical Review. These are indicated by (A) or (L) preceding the date in the reference, as is customary, but they should not be confused with the above symbols.

References for which no symbol is given are described in the remarks on the spectrum. Many of these are theoretical in character, as for example, the one to Racah's paper (see Ne I) which deals with *jl*-coupling in the spectra of the Ne I type (sec. 5.2). Symbols have been omitted in general from references that are specialized in character as compared with those that can be more concisely described by the array of letters given above.

5. Spectroscopic Notation

Some details of spectrum analysis should perhaps be mentioned in order to explain the plan of presentation of spectroscopic data adopted here. According to the quantum theory each energy level is defined by an inner quantum number commonly known as J. The terms (groups of related levels) have multiplicities which are all odd (1, 3, 5, 7, . . .) or all even (2, 4, 6, 8, . . .) in a given spectrum. For terms of odd multiplicity the J-values are always integers, 0, 1, 2, 3, . . .; for those of even multiplicity the J-values are odd multiples of the fraction ½, denoted as ½, 1½, 2½, 3½, etc. Terms are further defined by azimuthal quantum numbers L that have for terms labeled S, P, D, F, G, H, I, K, etc., the values 0, 1, 2, 3, 4, 5, 6, 7, etc., respectively.

A term of a given kind and multiplicity consists of a definite number of energy levels whose inner quantum numbers are stipulated by the quantum theory. For example, an "S" term of multiplicity three has only one level with J-value equal to 1. This term is designated as $^3S_1$. A "D" term of multiplicity four consists of four levels whose J-values are 3½, 2½, 1½, ½, respectively, designated as $^4D_{3½}$, $^4D_{2½}$, $^4D_{1½}$, $^4D_{½}$. Tables giving the J-values of terms of each multiplicity are discussed in sec. 6.7.

The designation is further described by two other quantities discussed in sec. 5.1 and sec. 5.3: (1) a prefix that

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[8] Rev. Mod. Phys. **13**, No. 4, 233 (1941).

[9] The discrepancies between the ionization potentials in this book and those given by the writer in the RMT are, in general, due to the use of the older factor, 0.00012345, in calculating data for the Multiplet Tables.

[10] Nova Acta Reg. Soc. Sci. Uppsala (IV) **9**, No. 6 (1934).

serves to distinguish terms of the same type and multiplicity from each other and which, for simpler spectra, gives information about the electron configuration, and (2) a superscript "°" denoting that a term belongs to the odd set (sec. 5.1). The complete multiplet designation of any spectral line includes all of these quantities: multiplicity, azimuthal quantum number, and inner quantum numbers for both the lower and higher energy levels involved in the production of the line.

The lines normally observed in a spectrum, i. e., the permitted lines, do not result from differences among the levels of each term and every other term, but from differences (called combinations) between two sets of terms, one "even" and one "odd." Permitted lines are further restricted by the rules governing the J-values. Only those J-value combinations between even and odd terms for which J changes by 0 or ± 1 are permitted, and normally no combinations occur between levels with $J=0$. Under special conditions "Forbidden" lines are observed, in which case these selection rules for odd and even terms and for J-values do not hold.

A relatively limited number of terms can thus account for a complex array of spectral lines. It is obviously desirable to describe these terms by a uniform notation that defines the quantum properties as completely as possible, and is also adaptable to all the varieties of spectra that have been and are likely to be observed.

A general scheme of notation was outlined in 1929,[11] which has been widely used. This scheme has been interpreted so freely by various investigators that a serious lack of uniformity has resulted in the literature. When this question arose in connection with the RMT the writer did not anticipate the present project, which is far wider in scope. She did, however, attempt to introduce uniformity and, in order to avoid further confusion, she has adopted here the notation of the RMT with only slight modifications. It is admittedly far from ideal, but is perhaps justifiable if it serves only to stimulate serious consideration of the question and the general adoption of a more satisfactory scheme.

The "Designation" (sec. 6.3) adopted for the less complex spectra that exhibit conspicuous series differs from that used for the more complex spectra that do not.

5.1. Series Spectra

For many elements the spectra become more complex as the degree of ionization decreases. The terms of each spark spectrum are the parent terms or "limits" of the series of terms in the spectrum of next lower degree of ionization. The term arrays resulting from the addition of s, p, d, f, etc., electrons to each limit are well known from theory (sec. 7). Consequently, for the simpler spectra the electron configurations of the observed terms

can be assigned without ambiguity by a study of the limits in the spectrum of next higher degree of ionization.

The spectrum of O VI may be used as an illustration. Here the lowest term of O VII, $1s^2\,^1S$, is so much lower than any other that no other limit need be considered. The addition of a "running" s, p, d, f, etc., electron to this state produces a series of doublet S, P°, D, F°, etc., terms in O VI. In this case the electrons and terms are of the same type. The ground term of O VI is $1s^2(^1S)2s\,^2S$, the next term is $1s^2(^1S)2p\,^2P°$, etc., where (^1S) signifies the parent term or limit in O VII. The "Designations" adopted for these terms are $2s\,^2S$, $2p\,^2P°$, etc.[12] The number "2" in the prefix $2s$, etc., denotes the total quantum number, which depends on the shell occupied by the outer electrons giving rise to the term (see sec. 7). This number increases by unity for the series terms of a given type, as for example, for the series $2s\,^2S$, $3s\,^2S$, $4s\,^2S$, etc.

An additional electron is effective in the production of the spectrum of O V. The configuration $1s^2\,2s^2$ gives the ground term ^1S, designated here as $2s^2\,^1S$; and $1s^2\,2p^2$ gives the terms $2p^2\,^3P$, $2p^2\,^1D$ and $2p^2\,^1S$. The spectrum of O V is more complex because, in addition, there are two low terms in O VI, both of which are important parent terms or "limits" giving rise to terms in O V. The addition of running electrons to these limits gives, among others, the following theoretical or predicted array of terms:

O VI		O V		
Config.	Limit	Added Electron	Config.	Terms
$1s^2\,2s$	^2S	$3s$	$1s^2\,2s(^2S)3s$	$\begin{cases}^3S\\^1S\end{cases}$
''	''	$2p$	$1s^2\,2s(^2S)2p$	$\begin{cases}^3P°\\^1P°\end{cases}$
''	''	$3d$	$1s^2\,2s(^2S)3d$	$\begin{cases}^3D\\^1D\end{cases}$
$1s^2\,2p$	$^2P°$	$3s$	$1s^2\,2p(^2P°)3s$	$\begin{cases}^3P°\\^1P°\end{cases}$
''	''	$3p$	$1s^2\,2p(^2P°)3p$	$\begin{cases}^3S & ^3P & ^3D\\^1S & ^1P & ^1D\end{cases}$
''	''	$3d$	$1s^2\,2p(^2P°)3d$	$\begin{cases}^3P° & ^3D° & ^3F°\\^1P° & ^1D° & ^1F°\end{cases}$

Terms are "odd" (denoted by the superscript "°") when the configuration contains an odd number of p, f, h, etc. electrons, $^3P°$, for example. In the case of O V, since one limit is even and the other one odd, no ambiguity occurs if a designation consisting of the running electron and term is used for terms from both limits, i. e., for terms from ^2S in O VI, $3s\,^3S$, $3s\,^1S$, $2p\,^3P°$, $2p\,^1P°$,

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[11] H. N. Russell, A. G. Shenstone, and L. A. Turner, Phys. Rev. **33**, 900 (1929).

[12] In the RMT the notation 2 ^2S, 2 $^2P°$, etc. was used for series of this kind when the term and running electron were of the same type.

$3d\,^3D$, $3d\,^1D$; and for terms from $^2P^\circ$ in O VI, $3s\,^3P^\circ$, $3s\,^1P^\circ$, $3p\,^3S$, $3p\,^3P$, ... $3d\,^1F^\circ$. This notation has been adopted for those spectra that have two low limits, one even and one odd.

When two or more of the effective limits are all even or all odd, an addition to this notation is required. The limit terms are always listed in the term arrays (sec. 7) from lowest to highest, i. e., according to increasing value of the terms, starting from zero. In O v the ground term is ^2S and the next higher is $^2P^\circ$. Consequently, ^2S is listed first in the above array and in the one on page 57. For terms from the lowest of a group of limits the running electron is used as described above. For those from the *next higher* or *second* limit a prime is affixed to the running electron, for those from the third limit a double prime, etc. The use of primes is well illustrated by the term arrays: (1) of O IV, p. 55, where the lowest limit is even and the next odd, in which case primes are first introduced for the *third* limit; and (2) that of O II, p. 50, where the primes are used for the *second* limit, since the two lowest limits are even.

With the exception of the spectra of the inert gas type (sec. 5.2), the notation giving the running electron with primes affixed as described above has been used for the spectra of all isoelectronic sequences through K and for the spectrum of Ca I. The rest of the Ca I sequence and the Sc I, Ti I, and V I sequences have the notation adopted for complex spectra (secs. 5.3 and 7.5).

5.2. Inert Gases

The first spectra of the inert gases form a special class of series spectra that must be discussed separately. In these neutral atoms the last electron required to close the different shells is added. Terms are not definitely distinguishable for many types of higher series members owing to the departure from LS-coupling, and the J-values of the components of the limit term must be indicated. A detailed account of the theory of the couplings of various types will not be attempted here. Briefly summarized, when LS-coupling does not hold, jl- or jj-coupling becomes important, the Landé g-values (tables 1 to 4), (sec. 6.7) do not hold, and levels are grouped by pairs rather than by terms. For further details, special treatises on the subject should be consulted.[13]

The present volume contains two sequences of this type: Ne I and A I. In these spectra the last of the six p-electrons is added and completes these shells.

As stated in the remarks for Ne I, Edlén suggested that a pair-coupling notation be adopted for Ne I-like spectra to take into account the departure from LS-coupling. The jl-coupling notation in the general form suggested by Racah[14] has, consequently, been adopted, on Shortley's suggestion. Shortley has also prepared a detailed array of the theoretical arrangement of the pairs, for the writer to use as a guide in preparing the tables of spectra of this type.

A few general remarks will suffice to explain the general plan of presentation. All levels from a given configuration are in one group. The groups are listed in order of increasing value of the smallest level in each group. Within a group the levels are paired and the pairs form two subgroups, each of which has as a limit one of the two components of a $^2P^\circ$ term, $^2P^\circ_{1\frac{1}{2}}$ and $^2P^\circ_{\frac{1}{2}}$, the former being the lower. Within the subgroup members of a pair are listed together in order of increasing value of the lower member, unless they are widely separated numerically, in which case the lower pairs precede the higher member of the wide pair. Each pair consists of two levels whose J-values are known from theory, and differ by only one unit. The designation of the pair gives the running electron, followed by the mean value of the two quantum numbers given in brackets. As usual, a prime is used with the running electron to indicate the higher limit.

The spectrum of Ne I may be used as an illustration. The pairs from the $3s$-configuration form one group. The next group in order of increasing numerical value of the lowest member is $3p$, the next is $4s$, etc. Within the $3s$ group one pair having $J=2$, 1, respectively, has the limit ($^2P^\circ_{1\frac{1}{2}}$) in Ne II, and is designated as $3s[1\frac{1}{2}]^\circ$, where the "$\circ$" has the usual meaning. The second pair in the $3s$ group has the higher limit ($^2P^\circ_{\frac{1}{2}}$) in Ne II and J-values 0 and 1, respectively. The designation is, therefore, $3s'[\frac{1}{2}]^\circ$. In the group having the $3p$-configuration the components of pair 1, 0 are widely separated, 148259 and 150919, respectively. They are listed separately in numerical order within the subgroup having the limit ($^2P^\circ_{1\frac{1}{2}}$), each member being labeled $3p[\frac{1}{2}]$. Then follows the related subgroup $3p'[1\frac{1}{2}]$, etc., with the pairs listed in increasing order.

The spectra to which the pair-coupling applies are listed under the Ne I and A I isoelectronic sequences in table 26.

For convenience of cross reference to Bacher and Goudsmit's book and to other publications, the Paschen notation for these spectra has been retained in column 1. Unfortunately, the jl-coupling notation was not used in the RMT, but it is hoped that the style adopted there can be translated into the present form by means of the table on page XVII of that Contribution.[15]

[13] E. Back and A. Landé, *Zeemaneffekt und Multiplettstruktur der Spektrallinien*, (Julius Springer, Berlin, 1925).
F. Hund, *Linienspektren und Periodisches System der Elemente* (Julius Springer, Berlin, 1927).
R. F. Bacher and S. Goudsmit, *Atomic Energy States* (McGraw-Hill Book Co., Inc., New York, N. Y. and London, 1932).
H. E. White, *Introduction to Atomic Spectra* (McGraw-Hill Book Co., Inc., New York, N. Y., and London, 1934).
E. U. Condon and G. H. Shortley, *The Theory of Atomic Spectra* (The Macmillan Co., New York, N. Y.; The University Press, Cambridge, Eng., 1935).

[14] Phys. Rev. **61**, 537 (L) (1942).
[15] *A Multiplet Table of Astrophysical Interest*, Princeton Univ. Obs. Contr. No. 20 (1945).

5.3. Complex spectra

In the majority of complex spectra the terms are so numerous that it is impracticable to designate them by their configurations. For these spectra the prefixes, *a*, *b*, *c*, *d* are assigned to the low terms of each type (even or odd) and *z*, *y*, *x*, etc., to those that combine with them (odd or even). The high terms of the same type as the low ones start with the prefix *e* and continue through *f*, *g*, etc.

This notation for complex spectra is first used for Sc II in the present volume. It is also used for all subsequent spectra of the Ca I sequence and for the spectra of the Sc I, Ti I, and V I sequences. These spectra are discussed further in sec. 7.5.

In many complex spectra it is impossible to group all known levels into spectroscopic terms. Miscellaneous levels are assigned numbers, and the superscript "°" if they belong to the odd set.

6. Columns of the Table

The data on atomic energy levels are presented in a maximum number of seven columns in the tables. These columns may be described as follows, although the numbers on the left serve only as a guide to the order of presentation, since all are not needed for every spectrum.

Column	Description	Tabular Entry
1	Author	Edlén, Paschen, Author
2	Configuration	Config.
3	Designation	Desig.
4	Inner Quantum Number	*J*
5	Atomic Energy Level	Level
6	Interval	Interval
7	Observed *g*-value	Obs. *g*

6.1. Author

Column one gives the notation used in individual papers on the analysis of certain spectra. For many spectra discussed by Edlén, i. e., mostly spectra of the light elements, the heading "Edlén" is used to indicate his notation.

As stated above, the heading "Paschen" is given for spectra of the inert gas type, meaning that the column contains Paschen's notation.

Frequently "Author" or "Authors" and, occasionally, initials are used as a heading. This is explained in the remarks and references for the spectrum in question.

This column is used only when necessary to enable the reader to translate the notation in the literature into that adopted in the "Designation" column for the sake of uniformity. It is omitted for the simpler spectra and for those in which no ambiguity can occur in the interpretation of the individual papers on analysis.

6.2. Configuration

Column two gives the electron configuration. For the simpler spectra, where only one limit term is involved, the limit is not repeated in the configuration for each term.

Similarly, the electrons in closed shells are given only when necessary. For example, in Li I, p. 9, all terms have the limit (^{1}S) in Li II, and two electrons form the closed 1*s* shell. The complete configuration of the ground term 2*s* ^{2}S is 1*s*^{2}(^{1}S)2*s*, here called 2*s* for brevity. Similarly, for the next term, 2*p* ^{2}P°, it is 1*s*^{2}(^{1}S)2*p*, called 2*p*, etc. For each spectrum, any electrons not mentioned in the configuration column may be found in the heading giving the ground state.

In more complex spectra, all electrons and limits needed to explain the terms are given, the limit terms being in parentheses, as usual. In C II, p. 24, for example, the term at 116537.88 has the limit (^{1}S) in C III, as indicated by the configuration 2*s*^{2}(^{1}S)3*s*. The rules governing the use of primes for terms from different limits have been described in detail in sec. 5.1.

The *J*-value indicating the component of the limit term responsible for certain terms or levels is of considerable theoretical interest. Many papers discuss this question. No attempt has been made to list here the *J*-values for the limit terms except in the case of inert gas spectra (sec. 5.2).

6.3. Designation

The designation column has been explained in sec. 5. Spectra have been divided into three classes and a uniform designation adopted for each class. For series spectra, the running electron without or with primes is given as a prefix to the term. For inert gas spectra the *jl*-coupling notation of the related pairs of levels is used. For complex spectra the prefixes *a*, *b*, ... *e*, *f*; *z*, *y*, *x*, ... are given.

Miscellaneous levels are assigned numbers and odd levels are indicated throughout by the symbol "°."

Other miscellaneous designations, which are usually self-explanatory, are also used. In F I, p. 60, for example, the type of notation adopted by Edlén for miscellaneous levels from the 3*d* and 4*d* configurations, 3*d* X$_2$, etc., has been retained. Edlén remarks that it is impos-

sible to assign term designations to these levels because of the departure from *LS*-coupling.

6.4. Inner Quantum Number *J*

This column gives the inner quantum number *J* for each level when known, or the quantum numbers of all components of a term if the term is unresolved into its component levels. For brevity the end quantum numbers of a term are frequently given for unresolved terms. For example, the term of F II, p. 63, at 264610 is an unresolved ^{5}F term. A ^{5}F term consists of 5 components with *J*-values of 5, 4, 3, 2, 1, respectively. They are denoted as "5 to 1" in the column headed *J*. The *J*-values for terms of the various types, S, P, D, etc., and multiplicities are given in tables 1 and 2. A blank in this column indicates that the author has not defined the *J*-value. In sec. 6, following, *J*-values are discussed further.

As a rule, *J*-values can be determined from the observed combinations. In the spectra of Ne I and A I, however, Shortley has suggested that special care be taken to indicate those that are verified by observation in the case of levels produced by *f*-electrons, since some pairs overlap and some are unresolved. As an aid in the theoretical interpretation of these spectra, the *J*-values that are derived from the observed combinations involving *f*-electrons are entered in italics in the tables.

6.5. Atomic Energy Level

This column gives the atomic energy levels of the individual spectra, odd levels being in italics throughout. With the exception of H-like spectra they are, in general, *observed* values.[16] In a number of spectra extrapolated values estimated from isoelectronic sequence data are also included to supplement incomplete observational results. Brackets are used to denote extrapolated values.

For every spectrum the levels are listed from the ground state *zero*, i. e., *absolute values* are *not* given in these tables. The levels are grouped by terms, or by pairs in the case of the inert gas spectra (sec. 5.2). The terms are listed in order of increasing numerical value of the smallest level in each. Miscellaneous levels are given in proper numerical order between terms. For unresolved levels the effective mean value of the components is given. For terms in which only certain components have been observed, those levels that are known are listed with the known *J*-value, and blanks occur in the table opposite the *J*-values of the missing members.

The value of the limit referred to the *ground state of the atom of next higher stage of ionization*, i. e., the limit giving the *principal ionization potential*, is entered in bold face in the table. In spectra having terms with negative absolute values, the limit appears in the correct numerical place in the table and is followed by higher terms. More often, it appears at the end of the table, following a row of leaders which indicate that many high terms have not yet been found. The value of the limit given in the heading is repeated in the table, throughout. Two limits are given for Ne I- and A I-like spectra, when the absolute values of both components of the limit term ^{2}P$^\circ_{1\frac{1}{2}, \frac{1}{2}}$ are known, the lower limit being in bold-face type (see sec. 5.2).

The selection of the numerical value of the limit adopted here is frequently arbitrary, and those who are seriously interested in the best value should consult the references. The length and type of the series, the series formula used, the type of extrapolation, and many other factors affect the accuracy of the limit. The remarks contain relevant details regarding the evaluation of the limit. Higher limits, if any, can be calculated by the addition of the appropriate term values of the succeeding spectrum to the limit quoted here.

In many spectra no intersystem combinations connecting the terms of different multiplicity within a spectrum, have been observed. For these spectra a constant correction, x, which may be either positive or negative, must, therefore, be applied to the terms of one multiplicity, and a different constant y to those of another in spectra where terms of three multiplicities have been detected, in order to put all terms on the same scale. In the tables the entries "$+x$" and "$+y$" follow the levels of all such sets of terms.

If long series have been observed the relative positions of the terms of different multiplicity can be determined accurately from the series limits, and the correction x is small.[17] In many cases series are short or lacking and the error may be considerable. Estimated relative positions of terms have, however, frequently been used in order to place all terms in the order that is approximately correct. The remarks on the spectrum and the use of brackets to denote estimated values should suffice to explain the procedure in the individual cases.

The uncertainty x is also occasionally used to indicate groups of detached terms that have not yet been connected by observation with the rest of the spectrum, but whose multiplicity is the same as that of terms that are known. This is true for a group of terms of Sc I, for example (p. 260).

6.6. Interval

The term intervals in this column are, with a very few exceptions, the differences between the level values of the

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[16] For spectra of the H sequence the values calculated by J. E. Mack from the series formula are given, as is explained in the remarks.

[17] In a few spectra x has been omitted for this reason, as noted in the remarks.

components of terms in the preceding column. If, for a given term, the level of smallest J has the smallest numerical value, and this succession holds for all components from the lowest to the highest, the intervals are positive and the term is *normal*. On the contrary, if the level of smallest numerical value has the largest J, etc., throughout the term, the intervals are negative and the term is *inverted*. The general run of intervals is positive or negative in a given spectrum according to whether the shell of outer electrons is less than or greater than half full (see sec. 7.1), although many exceptions to this general rule occur.

If some components of a term are missing, the order in which the J-values are listed is governed either by the foregoing rules concerning the shell, or by the behavior of other series members of the same type within the spectrum or the sequence.

The J-values are always given either in increasing or decreasing order for a term, even if the term may be partially inverted. For example, a ^3P term has its J-values listed either in the order 2, 1, 0 or 0, 1, 2 even if this arrangement causes the levels to be given out of numerical order. For such terms the signs of the intervals call attention to the irregularity, since both positive and negative intervals occur whenever the term is partially inverted. The term $3d\ ^5D$ of O III, p. 52, starting with the value 398135.0, is a term of this kind.

Estimated intervals are in brackets and are explained in the remarks.

6.7 Observed g-Value (Tables 1 to 4, Landé g-Values)

When a spectrum is observed in a magnetic field of suitable strength most lines are broken up into groups of related components arranged in definite patterns. The separations of the components are proportional to the magnetic field strength and to magnetic splitting factors (g-values) characteristic of the atomic energy levels. The g-values can be derived from a study of the observed patterns. These determine the multiplicity and the azimuthal and inner quantum numbers of the individual atomic energy levels. The theoretical g-values are well known for the individual levels of terms of all types. Consequently Zeeman patterns furnish one of the most reliable criteria for the correct interpretation of a complex spectrum.

Details of the theoretical and experimental aspects of this important subject will not be given here. Back and Landé, Bacher and Goudsmit, H. E. White,[18] and many others discuss it.

Observed g-values are given in the last column of the tables. There is a surprising scarcity of reliable data on observed Zeeman patterns among the spectra of the light elements. The first entries in the table are for N I.

Some papers state that the analysis is confirmed by the observed Zeeman effect but give no details. The general policy is to list here only those references that give observed g-values or sufficient data from which to calculate them. The accuracy of the Zeeman material varies greatly and depends on such factors as the determination of the magnetic field used for the observational data, the resolving power of the spectroscope, the interpretation of the observed effect, and many others. As a result the listed g-values vary greatly in accuracy.

For spectra in which LS-coupling holds the observed values agree well with the Landé theoretical g-values. Because of their importance in spectrum analysis, these theoretical values are given in tables 1, 2, 3, and 4. Table 1 contains J- and g-values for terms of types S, P, D ... Q of odd multiplicity, i. e., singlet, triplet, quintet, ... undecet terms. For example, the theoretical g-value of a $^3F_4$ level is 1.250; that of a $^7I_6$ level is 1.143. Since the data are identical for odd and even terms alike, one table suffices for both sets of terms. Table 2 gives similar data for terms of even multiplicity: doublets, quartets, ... decets.

For the convenience of those who are analyzing spectra, the theoretical g-values are also given in order of increasing numerical value followed by the designation of the level or levels for each g, for terms of odd multiplicity in table 3; and for those of even multiplicity in table 4. These g-values are quoted from the "Tables of Theoretical Zeeman Effects" by Kiess and Meggers,[19] supplemented by their unpublished data for terms of multiplicity greater than eight.[20] Their tables give also the theoretical Zeeman patterns for practically all of the multiplet designations that have been observed within the range of multiplicity they cover.

Tables of theoretical g-values for jj-coupling may be found in papers by J. B. Green and his collaborators.[21]

Finally, the date of completion of the manuscript of each spectrum is given at the end of the table of energy levels of the spectrum.

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[18] E. Back and A. Landé, *Zeemaneffekt und Multiplettstruktur der Spektrallinien* (Julius Springer, Berlin, 1925).

F. Hund, *Linienspektren und Periodisches System der Elemente* (Julius Springer, Berlin, 1927).

R. F. Bacher and S. Goudsmit, *Atomic Energy States* (McGraw-Hill Book Co., Inc., New York, N. Y. and London, 1932).

H. E. White, *Introduction to Atomic Spectra* (McGraw-Hill Book Co., Inc., New York, N. Y., and London, 1934).

E. U. Condon and G. H. Shortley, *The Theory of Atomic Spectra* (The Macmillan Co., New York, N. Y.; The University Press, Cambridge, Eng., 1935).

[19] Bur. Std. J. Res. **1**, 641, RP23 (1928).

[20] They have extended their tables of theoretical Landé g-values to include all types of terms and multiplicities (up to ^{11}Q) that are likely to be needed, in order that tables 1 to 4 may be complete. The writer is indebted to them for this useful contribution.

[21] Phys. Rev. **52**, 736 (1937); **54**, 876 (1938); **58**, 1094 (1940); **59**, 72 (1941); **64**, 151 (1943).

7. Tables of Predicted and Observed Arrays of Terms

With the exception of the simpler spectra and of those for which the analysis is seriously incomplete, arrays of observed terms are given following the individual tables of energy levels, the first being that of Be I, p. 13.

As stated above, the arrays of terms to be expected for a given configuration are well known from theory. A comparison of the terms observed in a given spectrum with those predicted reveals at once the completeness of the analysis. To facilitate this comparison, arrays of predicted terms arranged similarly to those of the observed terms are included here.

7.1. Shells

In the discussion of notation (sec. 5) reference was made to the "shells" of electrons and their importance in the production of spectroscopic terms. A clear description of these shells is quoted from White,[22] p. 80: "The various electrons are classified under so-called *shells* of electrons. *All electrons belonging to the same shell are characterized by the same total quantum number n. . . .*"

"The shells $n=1$, 2, 3, 4, . . . are sometimes called (from x-ray spectra) the K, L, M, N, . . . shells, respectively."

"The electrons in any shell n are further divided into *subshells* so that *electrons belonging to the same subshell have the same azimuthal quantum number l.* Electrons for which $l=0$, 1, 2, 3, . . . are called s, p, d, f, . . . electrons, respectively, . . .". For example, $2s$ is used to specify one electron with $l=0$ and in the shell $n=2$.

No shell can contain more than 2 type-s electrons starting with $n=1$, 6 type-p electrons starting with $n=2$, 10 type-d electrons starting with $n=3$, or 14 type-f electrons starting with $n=4$, etc. The successive periods 1 to 7 in the periodic system (sec. 8.3) can, therefore, contain only 2, 8, 8, 18, 18, 32, and 32 elements, respectively. These are consequences of Pauli's exclusion principle.

This is illustrated in the following brief tabular excerpt from White's complete Table of Electron Configurations:

Shell		K $n=1$	L $n=2$	
Subshell		$l=0$	$l=0$	$l=1$
1	H	$1s$		
2	He	$1s^2$		
3	Li	$1s^2$	$2s$	
4	Be	$1s^2$	$2s^2$	
5	B	$1s^2$	$2s^2$	$2p$
6	C	$1s^2$	$2s^2$	$2p^2$
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[22] H. E. White, *Introduction to Atomic Spectra* (McGraw-Hill Book Co., Inc., New York, N. Y., and London, 1934).

Superscripts denote the number of electrons of a given type. Where no superscript is given unity is understood. He I, for example, has two electrons of the type $1s$, as indicated by $1s^2$ in the above array. These similar electrons are known as *equivalent* electrons. The terms produced by *equivalent* and *nonequivalent* electrons and detailed discussions of Pauli's exclusion principle may be found in many standard treatises on atomic spectra.[23]

All spectra having the same shells of electrons are similar. An *isoelectronic sequence* consists of spectra of different elements having the same shells of electrons. Each *arc* spectrum sets the pattern for the sequence, so far as the effective electrons are concerned. For example, the spectra of Be I, B II, C III, etc., form an isoelectronic sequence for which Be I, the *arc* spectrum of beryllium, sets the pattern, i. e., the Be I isoelectronic sequence. In B II, the first spark spectrum of B, the boron atoms have lost the outer electron, $2p$. This spectrum, therefore, resembles that of Be I having two $2s$ electrons (denoted by $2s^2$) outside the closed shell $1s^2$. Similarly the carbon atoms have lost both outer $2p$-electrons when the spectrum of C III is observed. This spectrum thus belongs in the same sequence. An array of predicted terms of each arc spectrum suffices, therefore, for all spectra of the sequence, as, for example, Be I.

No arrays are given for spectra of the H, He I, Li I, and similar sequences. Since only $1s$, $1s^2$, and $2s$ electrons are involved, the arrays of predicted and observed terms are simple.

7.2. Arrays of Predicted Terms of the Sequences Be I Through Ne I (Tables 5 to 11)

Starting with Be I, predicted arrays of terms of the isoelectronic sequences from Be through Ne are given in the following tables (pages XXVIII to XXXI):

Table	Sequence
5	Be I
6	B I
7	C I
8	N I
9	O I
10	F I
11	Ne I

In all of these tables the closed shells are indicated immediately under the heading "Config." ("$1s^2+$" for this group of spectra). The tables are divided into two sections. The upper half gives the terms from equivalent

[23] H. N. Russell, Phys. Rev. **29**, 782 (1927).
R. C. Gibbs, D. T. Wilbur, and H. E. White, Phys. Rev. **29**, 790 (1927).
F. Hund, *Linienspektren und Periodisches System der Elemente* (Julius Springer, Berlin, 1927).
C. L. B. Shudeman, J. Franklin Inst. **224**, 501 (1937). (Terms from equivalent g, h, and i electrons.)

electrons and, for simpler spectra, the first low series members. The lower half indicates the series to be expected from the various limit terms (sec. 5.1), with the running electron denoted as nx, where n is the total quantum number, and x the type of electron, s, p, d, f, . . ., etc.

The quantities n and x are indicated in the headings, nx ($n \geq 3$), etc., above the columns of the tables and are evaluated in the arrays of observed terms of the separate spectra of the sequence. For example, the $ns\,^3S$ series of Be I, p. 13, with the configuration $2s(^2S)nx$ has been observed from $n=3$ through $n=8$.

Many more terms can be predicted than are likely to be observed. The present tables are designed to contain enough predicted terms to suffice for all terms thus far observed in any spectrum of the sequence.

7.3. Arrays of Predicted Terms of the Sequences Mg I Through A I, (Tables 12 to 18)

Starting with Mg I, arrays of predicted terms of the isoelectronic sequences from Mg through A are given in the following tables (pages XXXII to XXXV):

Table	Sequence
12	Mg I
13	Al I
14	Si I
15	P I
16	S I
17	Cl I
18	A I

A comparison of these tables with the set described above, tables 5 to 11, shows that the same terms are predicted for spectra having the same numbers and types of electrons outside the closed shells. Beginning with table 12, the closed shells are $1s^2\,2s^2\,2p^6$ (entered directly under the heading "Config." in the tables). The total quantum number n of the running electron is one unit larger, but the term arrays are identical for similar spectra in the two sets of tables. For example, tables 5 and 12, 6 and 13, etc., are alike, except for the total quantum numbers and for the number of predicted terms included, which is governed by the terms that have been observed within the sequence.

7.4. Arrays of Predicted Levels of the Ne I and A I Sequences (Tables 11 and 18)

These tables give both predicted terms (LS-coupling) and predicted pairs of levels (jl-coupling) sec. 5.2. In the arrays of predicted and observed pairs of levels for these spectra, the pairs are listed in the general order of increasing value of the lower member of the pair, as suggested by Shortley. As some spectra in this sequence are

of an intermediate type, more nearly LS-coupling, this order is not always obeyed numerically among the observed levels, but is retained in these tables for uniformity.

Similarly, in all of these tables (5 to 18, inclusive) and the corresponding arrays of observed terms, the limit terms are listed in the general order of increasing numerical value with primes added to indicate higher limits, as described in section 5.1.

7.5. Arrays of Predicted Terms of the Sequences Ca I Through V I (Tables 19 to 22)

Brief mention has been made of the special notation adopted for complex spectra (sec. 5.3). An examination of the tables for the sequences Ca I, Sc I, Ti I, and V I, tables 19 to 22, inclusive, reveals the rapid increase in the number of terms after d electrons are included in the structure of the unexcited atom. The use of primes is retained to indicate the different limits in Ca I and in table 19. For Sc II and subsequent spectra in the sequence, the notation for complex spectra is introduced (see below). Since the limits are carefully specified, no difficulty should arise in comparing the arrays of observed and predicted terms in this sequence.

For the configurations involving equivalent electrons, listed in the upper section of each array, Pauli's principle restricts the array of resulting terms, and the latter cannot be unequivocally assigned to specific limits.

When only s and p electrons appear in the low configurations the ground state is always to be found in the upper section, but in the lower, when d electrons are present in a configuration involving one s electron. Examples among arc spectra may be found in table 23, and others occur for singly ionized atoms.

Beginning with the Sc I sequence terms from eight limits must be considered. For this reason, a simple type of prefix a, b, c, . . . z, y, x, etc., is adopted for the terms from the different limits. In the Ti I group 15 limits must be handled, and in V I the number increases to 22. For these complex spectra the limits in the tables of predicted terms are tabulated in order of increasing numerical value of the terms in the arc spectrum of the sequence, Ti I for example. The same order does not necessarily apply to the other spectra in the sequence. In the arrays of observed terms the prefixes a, b, etc., of the limit terms are given in order to avoid confusion in comparing the different sets of tables.

As the complexity of the spectra increases there is a serious overlapping of families of terms from the various limits. The assignment of electron configurations is ambiguous in many cases. Beginning with Ti I, a number of question marks and colons appear in the arrays of observed terms, denoting the uncertainty of many suggested configurations.

8. The Periodic Table

8.1. The Chemical Elements by Atomic Number, Ionization Potentials (Table 23)

In the present work the elements are handled in order of increasing atomic number and they are listed in this order in table 23. Column one gives this number, Z; column two, the name of the element; and column three, the chemical symbol. Columns four and five give, respectively, the principal ionization potential and configuration of the ground state of the neutral atom. For elements with $Z > 23$, i. e., for those beyond the range of the present volume, these data are taken from table 1, columns 5 and 9, respectively, of the key to the Periodic Chart of the Atoms revised in 1947 by Meggers.[24] Additional data on the ground states of the rare earths are given in his paper on this subject.[25]

8.2. The Chemical Elements by Chemical Symbol (Table 24)

Bacher and Goudsmit arranged the spectra in the alphabetical order of the chemical symbol of the element. Table 24 gives the elements in this order, with the chemical symbol in column one followed by the name of the element in column 2 and the atomic number in column 3.

8.3. The Periodic System (Table 25)

The Periodic System in table 25 is arranged in the form suggested by Catalán, who generously furnished an unpublished copy for inclusion here.

8.4. Index—Isoelectronic Sequences (Table 26)

This table contains the index to the data in Volume I of this work, the spectra from H through V. In the left margin the atomic number is given, followed by the chemical symbol. Across the top the successive stages of ionization appear, I denoting arc spectra, II first spark spectra, III second spark spectra, etc. The numbers in the table indicate the pages on which the individual spectra may be found. For example, F VIII is on page 75.

In this table, isoelectronic spectra appear on the diagonals. Every other diagonal is printed in bold face type in order to emphasize the spectra of each sequence. For example, S IX belongs to the O I sequence, printed in bold-face along the diagonal. Similarly, Mg VI can be traced to N I along the diagonal not printed in bold face. Blanks occur for spectra that have not yet been analyzed.

No sequences are carried beyond V in this volume, but they will be continued in later volumes and indicated in tables arranged similarly to this one. The sequences started in Volume I but not completed there are listed below. The last spectrum in each sequence for which any data on analysis are known is indicated.

Sequence	Spectrum	Sequence	Spectrum
Ne I	Co XVIII	Cl I	Ni XII
Na I	Cu XIX	A I	Fe IX
Mg I	Co XVI	K I	Fe VIII
Al I	Ni XVI	Ca I	Ni IX
Si I	Ni XV	Sc I	Ni VIII
P I	(V IX)[1]	Ti I	Ni VII
S I	Ni XIII	V I	Cu VII

[1] This sequence is completed in the present volume.

9. Future Investigations

9.1. Need for Further Analysis

During the course of this compilation many interesting problems have presented themselves. The gaps in the sequences call attention to some spectra in which no structure has as yet been recognized. Within the sequences these gaps include the following spectra: Ne VII, VIII, IX; Na X; S XI; Cl XII, XIII; A XII, XIII; K XII, XIII, XIV; Ca XIV; and V X. If, in addition, F IX and Ne X could be observed, the spectra of all possible stages of ionization would be represented for these two elements.

A careful study of the configurations in which a $3d$ electron becomes effective, is desirable. In the F I sequence the terms with $3d$ and $4d$ electrons for Na III, Mg IV, Al V, and Si VI should be verified, as there are marked irregularities along this sequence.

In Si II the $3d$ $^3D°$ term is lower than $3p^3$ $^3D°$, but the reverse is true for the rest of the sequence.

In the P I sequence the configuration assignments of terms in which $3p^4$, $3d$, and $4s$ electrons are involved, should be examined along the sequence. More observations are also needed to verify the extensive extrapolations from K V on.

Similar remarks apply to some spectra of the Cl I sequence, particularly to Ca IV, where various authors disagree on the interpretation. Analogous terms along this sequence are strikingly irregular as regards both position and intervals. Many such irregularities could be pointed out. It is hoped that the present work will stimulate further study along these lines.

[24] W. M. Welch Scientific Co., 1515 Sedgwick St., Chicago 10, Ill., U. S. A. (Chart and key, $7.50; key, $1.00). For Mn I and Mo I Catalán's revised values are quoted. The data on Tc I are from Meggers.
[25] Electron Configurations of "Rare-Earth" Elements, Science 105, 514, No. 2733 (May 16, 1947).

The arrays of observed terms enable one to detect a number of conspicuous missing terms whose positions can be estimated by analogy with neighboring related terms. For example, Russell [26] has suggested that the $3d'''$ ^2G term in O IV might be found. To quote him "It should give a strong combination with $3p'''$ $^2F°$, lying in the violet or near ultraviolet." Similarly, the absence of the $3d$ ^2F term of Cl III is conspicuous. Russell has also commented on the incompleteness of the analyses of S III and S IV.

In He I the term $11s$ ^1S is missing from the series. In Mg I Shortley has called attention to the fact that the triplets are higher than the singlets, an anomaly that appears to be unexplained.

The general need for further analysis can perhaps best be visualized by a comparison of the arrays of observed and predicted terms of the various spectra. This procedure enables the user to grade each analysis for himself. For spectra whose energy levels are not yet tabulated for this program it is recommended that he consult the existing surveys of spectrum analysis.[27]

Perhaps the most urgent needs of the astrophysicist are extensions to the work on the second and third spark spectra in the first long period (except for Fe III, which is well known). Many spectra of the heavier elements are incompletely analyzed and much work remains to be done on the highly complex spectra of the rare earths.

9.2. Term Intervals

A careful examination of the term intervals within a spectrum and in related spectra affords a useful check on the correctness of the analysis. In regular terms the intervals are roughly proportional to the larger J-values of the term, and term separations of similar terms usually increase smoothly along the sequence. Enough data are presented here for an extensive survey of this subject. The theoretical as well as observational aspects of this topic and its important relation to configuration assignments need not be emphasized to workers on spectrum analysis.

9.3. Series Spectra—Rydberg Denominators

Requests have been made for a tabulation of absolute term values and Rydberg denominators of the series members of each spectrum in which series have been detected, including the J-values of the limit terms. The need for a critical compilation of this material is fully appreciated. It is felt, however, that such a project can best be handled in a program restricted to the study of series in atomic spectra. Standard treatises such as Fowler's *Report on Series in Line Spectra* and Paschen-Götze's *Seriengesetze der Linienspektren*, the paper by Catalán and Poggio,[28] etc., together with other references included under the separate spectra should provide some data for those who are interested.

9.4. Observed Zeeman Patterns

A glance at the data on Zeeman effect in this volume alone, reveals a glaring need of further observations. The first entry of g-values occurs in the spectrum of N I. An outstanding example may be found in Ti I. The best observed g-values obtainable from existing data are given, and they serve remarkably well to confirm the analysis. For Ti, and also for other elements, however, Harrison [29] has made extensive observations that doubtless show many excellently resolved patterns and would yield precise observed g-values, but his data for a number of complex spectra have not yet been utilized. A wealth of information is in store for future study in this field.

9.5. Energy or Grotrian Diagrams

There have been urgent requests to prepare a homogeneous set of energy diagrams to accompany these tables. This topic is handled very inadequately here. If the individual authors have included either an energy level diagram or a Grotrian diagram,[30] this fact is indicated by the symbol (E D) or (G D) following the references. If not, recourse to general references such as Grotrian's classical publication [31] or White's *Introduction to Atomic Spectra* [32] must be had. Readers are warned that the existing diagrams are far from uniform in style and scale and that many of them are not up to date, i. e., they do not represent the analysis as given in the tables. In many cases, the most notable being probably that of A I, the writer has been unable to locate diagrams representing the analysis.

The present work would be seriously delayed by the inclusion of diagrams, but the energy levels as recorded here furnish the requisite material for such a project.

Only a few of the many interesting subjects for future investigation have been touched upon. If this work provides the inspiration and stimulus for at least some of them, it will have been justified.

[26] Letter (Aug. 1947).

[27] W. F. Meggers, J. Opt. Soc. Am. **36**, 433 (1946); C. E. Moore, RMT (1945).

[28] Zeit. Phys. **102**, 461 (1936).

[29] Reports on Progress in Physics **8**, 228 (1941).

[30] In energy diagrams only the positions of the levels or terms are indicated. In Grotrian diagrams lines indicating observed combinations connect the terms.

[31] *Graphische Darstellung der Spektren von Atomen und Ionen mit ein, zwei und drei Valenzelektronen*, Part II (Julius Springer, Berlin, 1928).

[32] H. E. White, *Introduction to Atomic Spectra* (McGraw-Hill Book Co., Inc., New York, N. Y., and London, 1934).

10. Acknowledgments

Table 1. Landé g-values

Term	Singlets 1		Triplets 3		Quintets 5		Septets 7		Nonets 9		Undecets 11	
	J	g	J	g	J	g	J	g	J	g	J	g
S	0	0/0	1	2.000	2	2.000	3	2.000	4	2.000	5	2.000
P	1	1.000	2	1.500	3	1.667	4	1.750	5	1.800	6	1.833
			1	1.500	2	1.833	3	1.917	4	1.950	5	1.967
			0	0/0	1	2.500	2	2.333	3	2.250	4	2.200
D	2	1.000	3	1.333	4	1.500	5	1.600	6	1.667	7	1.714
			2	1.167	3	1.500	4	1.650	5	1.733	6	1.786
			1	0.500	2	1.500	3	1.750	4	1.850	5	1.900
					1	1.500	2	2.000	3	2.083	4	2.100
					0	0/0	1	3.000	2	2.667	3	2.500
F	3	1.000	4	1.250	5	1.400	6	1.500	7	1.571	8	1.625
			3	1.083	4	1.350	5	1.500	6	1.595	7	1.661
			2	0.667	3	1.250	4	1.500	5	1.633	6	1.714
					2	1.000	3	1.500	4	1.700	5	1.800
					1	0.000	2	1.500	3	1.833	4	1.950
							1	1.500	2	2.167	3	2.250
							0	0/0	1	3.500	2	3.000
G	4	1.000	5	1.200	6	1.333	7	1.429	8	1.500	9	1.556
			4	1.050	5	1.267	6	1.405	7	1.500	8	1.569
			3	0.750	4	1.150	5	1.367	6	1.500	7	1.589
					3	0.917	4	1.300	5	1.500	6	1.619
					2	0.333	3	1.167	4	1.500	5	1.667
							2	0.833	3	1.500	4	1.750
							1	−0.500	2	1.500	3	1.917
									1	1.500	2	2.333
									0	0/0	1	4.000
H	5	1.000	6	1.167	7	1.286	8	1.375	9	1.444	10	1.500
			5	1.033	6	1.214	7	1.339	8	1.431	9	1.500
			4	0.800	5	1.100	6	1.286	7	1.411	8	1.500
					4	0.900	5	1.200	6	1.381	7	1.500
					3	0.500	4	1.050	5	1.333	6	1.500
							3	0.750	4	1.250	5	1.500
							2	0.000	3	1.083	4	1.500
									2	0.667	3	1.500
									1	−1.000	2	1.500
											1	1.500
											0	0/0
I	6	1.000	7	1.143	8	1.250	9	1.333	10	1.400	11	1.455
			6	1.024	7	1.179	8	1.292	9	1.378	10	1.445
			5	0.833	6	1.071	7	1.232	8	1.347	9	1.433
					5	0.900	6	1.143	7	1.304	8	1.417
					4	0.600	5	1.000	6	1.238	7	1.393
							4	0.750	5	1.133	6	1.357
							3	0.250	4	0.950	5	1.300
									3	0.583	4	1.200
									2	−0.333	3	1.000
											2	0.500
											1	−1.500
K	7	1.000	8	1.125	9	1.222	10	1.300	11	1.364	12	1.417
			7	1.018	8	1.153	9	1.256	10	1.336	11	1.402
			6	0.857	7	1.054	8	1.194	9	1.300	10	1.382
					6	0.905	7	1.107	8	1.250	9	1.356
					5	0.667	6	0.976	7	1.179	8	1.319
							5	0.767	6	1.071	7	1.268
							4	0.400	5	0.900	6	1.191
									4	0.600	5	1.067
									3	0.000	4	0.850
											3	0.417
											2	−0.667

Table 1. Landé *g*-values—Continued

Term	Singlets 1		Triplets 3		Quintets 5		Septets 7		Nonets 9		Undecets 11	
	J	g	J	g	J	g	J	g	J	g	J	g
L	8	1.000	9	1.111	10	1.200	11	1.273	12	1.333	13	1.385
			8	1.014	9	1.133	10	1.227	11	1.303	12	1.365
			7	0.875	8	1.042	9	1.167	10	1.264	11	1.341
					7	0.911	8	1.083	9	1.201	10	1.309
					6	0.714	7	0.964	8	1.139	9	1.267
							6	0.786	7	1.036	8	1.208
							5	0.500	6	0.881	7	1.125
									5	0.633	6	1.000
									4	0.200	5	0.800
											4	0.450
											3	−0.250
M	9	1.000	10	1.100	11	1.182	12	1.250	13	1.308	14	1.357
			9	1.011	10	1.118	11	1.205	12	1.276	13	1.335
			8	0.889	9	1.033	10	1.145	11	1.235	12	1.308
					8	0.917	9	1.067	10	1.182	11	1.273
					7	0.750	8	0.958	9	1.111	10	1.227
							7	0.804	8	1.014	9	1.167
							6	0.571	7	0.875	8	1.083
									6	0.667	7	0.964
									5	0.333	6	0.786
											5	0.500
											4	0.000
N	10	1.000	11	1.091	12	1.167	13	1.231	14	1.286	15	1.333
			10	1.009	11	1.106	12	1.186	13	1.253	14	1.310
			9	0.900	10	1.027	11	1.129	12	1.212	13	1.280
					9	0.902	10	1.055	11	1.159	12	1.244
					8	0.778	9	0.906	10	1.091	11	1.197
							8	0.819	9	1.000	10	1.136
							7	0.625	8	0.875	9	1.056
									7	0.696	8	0.944
									6	0.429	7	0.786
											6	0.548
											5	0.167
O	11	1.000	12	1.083	13	1.154	14	1.214	15	1.267	16	1.312
			11	1.008	12	1.096	13	1.170	14	1.233	15	1.288
			10	0.909	11	1.023	12	1.115	13	1.192	14	1.257
					10	0.927	11	1.045	12	1.141	13	1.220
					9	0.800	10	0.955	11	1.076	12	1.173
							9	0.833	10	0.991	11	1.114
							8	0.667	9	0.878	10	1.036
									8	0.722	9	0.933
									7	0.500	8	0.792
											7	0.589
											6	0.286
Q	12	1.000	13	1.077	14	1.143	15	1.200	16	1.250	17	1.294
			12	1.006	13	1.088	14	1.157	15	1.217	16	1.268
			11	0.917	12	1.019	13	1.104	14	1.176	15	1.238
					11	0.932	12	1.038	13	1.126	14	1.200
					10	0.818	11	0.955	12	1.064	13	1.154
							10	0.845	11	0.985	12	1.096
							9	0.700	10	0.882	11	1.023
									9	0.744	10	0.927
									8	0.556	9	0.800
											8	0.625
											7	0.375

Table 2. Landé *g*-values

Term	Doublets 2 J	g	Quartets 4 J	g	Sextets 6 J	g	Octets 8 J	g	Decets 10 J	g
S	½	2.000	1½	2.000	2½	2.000	3½	2.000	4½	2.000
P	1½	1.333	2½	1.600	3½	1.714	4½	1.778	5½	1.818
	½	0.667	1½	1.733	2½	1.886	3½	1.937	4½	1.960
			½	2.667	1½	2.400	2½	2.286	3½	2.222
D	2½	1.200	3½	1.429	4½	1.556	5½	1.636	6½	1.692
	1½	0.800	2½	1.371	3½	1.587	4½	1.697	5½	1.762
			1½	1.200	2½	1.657	3½	1.809	4½	1.879
			½	0.000	1½	1.867	2½	2.057	3½	2.095
					½	3.333	1½	2.800	2½	2.572
F	3½	1.143	4½	1.333	5½	1.455	6½	1.538	7½	1.600
	2½	0.857	3½	1.238	4½	1.434	5½	1.552	6½	1.631
			2½	1.029	3½	1.397	4½	1.576	5½	1.678
			1½	0.400	2½	1.314	3½	1.619	4½	1.758
					1½	1.067	2½	1.714	3½	1.905
					½	−0.667	1½	2.000	2½	2.229
							½	4.000	1½	3.200
G	4½	1.111	5½	1.273	6½	1.385	7½	1.467	8½	1.529
	3½	0.889	4½	1.172	5½	1.343	6½	1.456	7½	1.537
			3½	0.984	4½	1.273	5½	1.441	6½	1.549
			2½	0.571	3½	1.143	4½	1.414	5½	1.566
					2½	0.857	3½	1.365	4½	1.596
					1½	0.000	2½	1.257	3½	1.651
							1½	0.933	2½	1.772
							½	−1.333	1½	2.133
									½	4.667
H	5½	1.091	6½	1.231	7½	1.333	8½	1.412	9½	1.474
	4½	0.909	5½	1.133	6½	1.282	7½	1.388	8½	1.467
			4½	0.970	5½	1.203	6½	1.354	7½	1.459
			3½	0.667	4½	1.071	5½	1.301	6½	1.446
					3½	0.825	4½	1.212	5½	1.427
					2½	0.286	3½	1.048	4½	1.394
							2½	0.686	3½	1.333
							1½	−0.400	2½	1.200
									1½	0.800
									½	−2.000
I	6½	1.077	7½	1.200	8½	1.294	9½	1.368	10½	1.429
	5½	0.923	6½	1.108	7½	1.239	8½	1.337	9½	1.414
			5½	0.965	6½	1.159	7½	1.294	8½	1.393
			4½	0.727	5½	1.035	6½	1.231	7½	1.365
					4½	0.828	5½	1.133	6½	1.323
					3½	0.444	4½	0.970	5½	1.259
							3½	0.667	4½	1.152
							2½	0.000	3½	0.952
									2½	0.514
									1½	−0.800
K	7½	1.067	8½	1.176	9½	1.263	10½	1.333	11½	1.391
	6½	0.933	7½	1.090	8½	1.207	9½	1.298	10½	1.371
			6½	0.964	7½	1.129	8½	1.251	9½	1.343
			5½	0.769	6½	1.015	7½	1.184	8½	1.307
					5½	0.839	6½	1.087	7½	1.255
					4½	0.545	5½	0.937	6½	1.179
							4½	0.687	5½	1.063
							3½	0.222	4½	0.869
									3½	0.508
									2½	−0.286

Table 2. Landé g-values—Continued

Term	Doublets 2		Quartets 4		Sextets 6		Octets 8		Decets 10	
	J	g	J	g	J	g	J	g	J	g
L	8½	1.059	9½	1.158	10½	1.238	11½	1.304	12½	1.360
	7½	0.941	8½	1.077	9½	1.183	10½	1.267	11½	1.336
			7½	0.965	8½	1.108	9½	1.218	10½	1.304
			6½	0.800	7½	1.004	8½	1.152	9½	1.263
					6½	0.851	7½	1.059	8½	1.207
					5½	0.615	6½	0.923	7½	1.129
							5½	0.713	6½	1.015
							4½	0.304	5½	0.839
									4½	0.545
									3½	0.000
M	9½	1.053	10½	1.143	11½	1.217	12½	1.280	13½	1.333
	8½	0.947	9½	1.068	10½	1.164	11½	1.242	12½	1.307
			8½	0.966	9½	1.093	10½	1.193	11½	1.273
			7½	0.824	8½	0.997	9½	1.128	10½	1.230
					7½	0.863	8½	1.040	9½	1.173
					6½	0.667	7½	0.918	8½	1.096
							6½	0.738	7½	0.988
							5½	0.462	6½	0.831
									5½	0.587
									4½	0.182
N	10½	1.048	11½	1.120	12½	1.200	13½	1.259	14½	1.310
	9½	0.952	10½	1.060	11½	1.148	12½	1.221	13½	1.282
			9½	0.967	10½	1.081	11½	1.172	12½	1.247
			8½	0.842	9½	0.992	10½	1.110	11½	1.203
					8½	0.873	9½	1.028	10½	1.147
					7½	0.706	8½	0.916	9½	1.073
							7½	0.761	8½	0.972
							6½	0.533	7½	0.831
									6½	0.625
									5½	0.308
O	11½	1.043	12½	1.120	13½	1.185	14½	1.241	15½	1.290
	10½	0.957	11½	1.054	12½	1.135	13½	1.203	14½	1.261
			10½	0.969	11½	1.071	12½	1.156	13½	1.226
			9½	0.857	10½	0.990	11½	1.096	12½	1.182
					9½	0.882	10½	1.019	11½	1.127
					8½	0.737	9½	0.917	10½	1.056
							8½	0.780	9½	0.962
							7½	0.588	8½	0.836
									7½	0.659
									6½	0.400
Q	12½	1.040	13½	1.111	14½	1.172	15½	1.226	16½	1.273
	11½	0.960	12½	1.049	13½	1.124	14½	1.188	15½	1.243
			11½	0.970	12½	1.064	13½	1.142	14½	1.208
			10½	0.870	11½	0.988	12½	1.084	13½	1.165
					10½	0.890	11½	1.012	12½	1.111
					9½	0.762	10½	0.919	11½	1.043
							9½	0.797	10½	0.957
							8½	0.632	9½	0.842
									8½	0.687
									7½	0.471

TABLE 3. LANDÉ g-VALUES—TERMS OF ODD MULTIPLICITY IN ORDER OF INCREASING g

g	Desig.	g	Desig.	g	Desig.	g	Desig.
−1.500	$^{11}I_1$	0.744	$^{9}Q_9$	0.955	$^{7}O_{10}$ $^{7}Q_{11}$	1.076	$^{9}O_{11}$
−1.000	$^{9}H_1$	0.750	$^{3}G_3$ $^{5}M_7$ $^{7}H_3$	0.958	$^{7}M_8$	1.077	$^{3}Q_{13}$
−0.667	$^{11}K_2$		$^{7}I_4$	0.964	$^{7}L_7$ $^{11}M_7$	1.083	$^{3}F_3$ $^{3}O_{12}$ $^{7}L_8$
−0.500	$^{7}G_1$	0.767	$^{7}K_5$	0.976	$^{7}K_6$		$^{9}H_3$ $^{11}M_8$
−0.333	$^{9}I_2$	0.778	$^{5}N_8$	0.985	$^{9}Q_{11}$	1.088	$^{5}Q_{13}$
−0.250	$^{11}L_3$	0.786	$^{7}L_6$ $^{11}M_6$ $^{11}N_7$	0.991	$^{9}O_{10}$	1.091	$^{3}N_{11}$ $^{9}N_{10}$
0.000	$^{5}F_1$ $^{7}H_2$ $^{9}K_3$	0.792	$^{11}O_8$	1.000	$^{1}P_1$ $^{1}D_2$ $^{1}F_3$	1.096	$^{5}O_{12}$ $^{11}Q_{12}$
	$^{11}M_4$	0.800	$^{3}H_4$ $^{5}O_9$ $^{11}L_5$		$^{1}G_4$ $^{1}H_5$ $^{1}I_6$	1.100	$^{3}M_{10}$ $^{5}H_5$
0.167	$^{11}N_5$		$^{11}Q_9$		$^{1}K_7$ $^{1}L_8$ $^{1}M_9$	1.104	$^{7}Q_{13}$
0.200	$^{9}L_4$	0.804	$^{7}M_7$		$^{1}N_{10}$ $^{1}O_{11}$ $^{1}Q_{12}$	1.106	$^{5}N_{11}$
0.250	$^{7}I_3$	0.818	$^{5}Q_{10}$		$^{5}F_2$ $^{7}I_5$ $^{9}N_9$	1.107	$^{7}K_7$
0.286	$^{11}O_6$	0.819	$^{7}N_8$		$^{11}I_3$ $^{11}L_6$	1.111	$^{3}L_9$ $^{9}M_9$
0.333	$^{5}G_2$ $^{9}M_5$	0.833	$^{3}I_5$ $^{7}G_2$ $^{7}O_9$	1.006	$^{3}Q_{12}$	1.114	$^{11}O_{11}$
0.375	$^{11}Q_7$	0.845	$^{7}Q_{10}$	1.008	$^{3}O_{11}$	1.115	$^{7}O_{12}$
0.400	$^{7}K_4$	0.850	$^{11}K_4$	1.009	$^{3}N_{10}$	1.118	$^{5}M_{10}$
0.417	$^{11}K_3$	0.857	$^{3}K_6$	1.011	$^{3}M_9$	1.125	$^{3}K_8$ $^{11}L_7$
0.429	$^{9}N_6$	0.875	$^{3}L_7$ $^{9}M_7$ $^{9}N_8$	1.014	$^{3}L_8$ $^{9}M_8$	1.126	$^{9}Q_{13}$
0.450	$^{11}L_4$	0.878	$^{9}O_9$	1.018	$^{3}K_7$	1.129	$^{7}N_{11}$
0.500	$^{3}D_1$ $^{5}H_3$ $^{7}L_5$	0.881	$^{9}L_6$	1.019	$^{5}Q_{12}$	1.133	$^{5}L_9$ $^{9}I_5$
	$^{9}O_7$ $^{11}I_2$ $^{11}M_5$	0.882	$^{9}Q_{10}$	1.023	$^{5}O_{11}$ $^{11}Q_{11}$	1.136	$^{11}N_{10}$
0.548	$^{11}N_6$	0.889	$^{3}M_8$	1.024	$^{3}I_6$	1.139	$^{9}L_8$
0.556	$^{9}Q_8$	0.900	$^{3}N_9$ $^{5}H_4$ $^{5}I_5$	1.027	$^{5}N_{10}$	1.141	$^{9}O_{12}$
0.571	$^{7}M_6$		$^{9}K_5$	1.033	$^{3}H_5$ $^{5}M_9$	1.143	$^{3}I_7$ $^{5}Q_{14}$ $^{7}I_6$
0.583	$^{9}I_3$	0.902	$^{5}N_9$	1.036	$^{9}L_7$ $^{11}O_{10}$	1.145	$^{7}M_{10}$
0.589	$^{11}O_7$	0.905	$^{5}K_6$	1.038	$^{7}Q_{12}$	1.150	$^{5}G_4$
0.600	$^{5}I_4$ $^{9}K_4$	0.906	$^{7}N_9$	1.042	$^{5}L_8$	1.153	$^{5}K_8$
0.625	$^{7}N_7$ $^{11}Q_8$	0.909	$^{3}O_{10}$	1.045	$^{7}O_{11}$	1.154	$^{5}O_{13}$ $^{11}Q_{13}$
0.633	$^{9}L_5$	0.911	$^{5}L_7$	1.050	$^{3}G_4$ $^{7}H_4$	1.157	$^{7}Q_{14}$
0.667	$^{3}F_2$ $^{5}K_5$ $^{7}O_8$	0.917	$^{3}Q_{11}$ $^{5}G_3$ $^{5}M_8$	1.054	$^{5}K_7$	1.159	$^{9}N_{11}$
	$^{9}H_2$ $^{9}M_6$	0.927	$^{5}O_{10}$ $^{11}Q_{10}$	1.055	$^{7}N_{10}$	1.167	$^{3}D_2$ $^{3}H_6$ $^{5}N_{12}$
0.696	$^{9}N_7$	0.932	$^{5}Q_{11}$	1.056	$^{11}N_9$		$^{7}G_3$ $^{7}L_9$ $^{11}M_9$
0.700	$^{7}Q_9$	0.933	$^{11}O_9$	1.064	$^{9}Q_{12}$	1.170	$^{7}O_{13}$
0.714	$^{5}L_6$	0.944	$^{11}N_8$	1.067	$^{7}M_9$ $^{11}K_5$	1.173	$^{11}O_{12}$
0.722	$^{9}O_8$	0.950	$^{9}I_4$	1.071	$^{5}I_6$ $^{9}K_6$	1.176	$^{9}Q_{14}$

TABLE 3.   LANDÉ g-VALUES—TERMS OF ODD MULTIPLICITY IN ORDER OF INCREASING g—Continued

g	Desig.	g	Desig.	g	Desig.	g	Desig.
1.179	$^5I_7$ $^9K_7$	1.268	$^{11}K_7$ $^{11}Q_{16}$	1.381	$^9H_6$	1.625	$^{11}F_8$
1.182	$^5M_{11}$ $^9M_{10}$	1.273	$^7L_{11}$ $^{11}M_{11}$	1.382	$^{11}K_{10}$	1.633	$^9F_5$
1.186	$^7N_{12}$	1.276	$^9M_{12}$	1.385	$^{11}L_{13}$	1.650	$^7D_4$
1.191	$^{11}K_6$	1.280	$^{11}N_{13}$	1.393	$^{11}I_7$	1.661	$^{11}F_7$
1.192	$^9O_{13}$	1.286	$^5H_7$ $^7H_6$ $^9N_{14}$	1.400	$^5F_5$ $^9I_{10}$	1.667	$^5P_3$ $^9D_6$ $^{11}G_5$
1.194	$^7K_8$	1.288	$^{11}O_{15}$	1.402	$^{11}K_{11}$	1.700	$^9F_4$
1.197	$^{11}N_{11}$	1.292	$^7I_8$	1.405	$^7G_6$	1.714	$^{11}D_7$ $^{11}F_6$
1.200	$^3G_5$ $^5L_{10}$ $^7H_5$	1.294	$^{11}Q_{17}$	1.411	$^9H_7$	1.733	$^9D_5$
	$^7Q_{15}$ $^{11}I_4$ $^{11}Q_{14}$	1.300	$^7G_4$ $^7K_{10}$ $^9K_9$	1.417	$^{11}I_8$ $^{11}K_{12}$	1.750	$^7P_4$ $^7D_3$ $^{11}G_4$
1.201	$^9L_9$		$^{11}I_5$	1.429	$^7G_7$	1.786	$^{11}D_6$
1.205	$^7M_{11}$	1.303	$^9L_{11}$	1.431	$^9H_8$	1.800	$^9P_5$ $^{11}F_5$
1.208	$^{11}L_8$	1.304	$^9I_7$	1.433	$^{11}I_9$	1.833	$^5P_2$ $^9F_3$ $^{11}P_6$
1.212	$^9N_{12}$	1.308	$^9M_{13}$ $^{11}M_{12}$	1.444	$^9H_9$	1.850	$^9D_4$
1.214	$^5H_6$ $^7O_{14}$	1.309	$^{11}L_{10}$	1.445	$^{11}I_{10}$	1.900	$^{11}D_5$
1.217	$^9Q_{15}$	1.310	$^{11}N_{14}$	1.455	$^{11}I_{11}$	1.917	$^7P_3$ $^{11}G_3$
1.220	$^{11}O_{13}$	1.312	$^{11}O_{16}$	1.500	$^3P_2$ $^3P_1$ $^5D_4$	1.950	$^9P_4$ $^{11}F_4$
1.222	$^5K_9$	1.319	$^{11}K_8$		$^5D_3$ $^5D_2$ $^5D_1$	1.967	$^{11}P_5$
1.227	$^7L_{10}$ $^{11}M_{10}$	1.333	$^3D_3$ $^5G_6$ $^7I_9$		$^7F_6$ $^7F_5$ $^7F_4$	2.000	$^3S_1$ $^5S_2$ $^7S_3$
1.231	$^7N_{13}$		$^9H_5$ $^9L_{12}$ $^{11}N_{15}$		$^7F_3$ $^7F_2$ $^7F_1$		$^9S_4$ $^{11}S_5$ $^7D_2$
1.232	$^7I_7$	1.335	$^{11}M_{13}$		$^9G_8$ $^9G_7$ $^9G_6$	2.083	$^9D_3$
1.233	$^9O_{14}$	1.336	$^9K_{10}$		$^9G_5$ $^9G_4$ $^9G_3$	2.100	$^{11}D_4$
1.235	$^9M_{11}$	1.339	$^7H_7$		$^9G_2$ $^9G_1$ $^{11}H_{10}$	2.167	$^9F_2$
1.238	$^9I_6$ $^{11}Q_{15}$	1.341	$^{11}L_{11}$		$^{11}H_9$ $^{11}H_8$ $^{11}H_7$	2.200	$^{11}P_4$
1.244	$^{11}N_{12}$	1.347	$^9I_8$		$^{11}H_6$ $^{11}H_5$ $^{11}H_4$	2.250	$^9P_3$ $^{11}F_3$
1.250	$^3F_4$ $^5F_3$ $^5I_8$	1.350	$^5F_4$		$^{11}H_3$ $^{11}H_2$ $^{11}H_1$	2.333	$^7P_2$ $^{11}G_2$
	$^7M_{12}$ $^9H_4$ $^9K_8$	1.356	$^{11}K_9$	1.556	$^{11}G_9$	2.500	$^5P_1$ $^{11}D_3$
	$^9Q_{16}$	1.357	$^{11}I_6$ $^{11}M_{14}$	1.569	$^{11}G_8$	2.667	$^9D_2$
1.253	$^9N_{13}$	1.364	$^9K_{11}$	1.571	$^9F_7$	3.000	$^7D_1$ $^{11}F_2$
1.256	$^7K_9$	1.365	$^{11}L_{12}$	1.589	$^{11}G_7$	3.500	$^9F_1$
1.257	$^{11}O_{14}$	1.367	$^7G_5$	1.595	$^9F_6$	4.000	$^{11}G_1$
1.264	$^9L_{10}$	1.375	$^7H_8$	1.600	$^7D_5$		
1.267	$^5G_5$ $^9O_{15}$ $^{11}L_9$	1.378	$^9I_9$	1.619	$^{11}G_6$		

TABLE 4. LANDÉ g-VALUES FOR TERMS OF EVEN MULTIPLICITY IN ORDER OF INCREASING g

g	Desig.			g	Desig.			g	Desig.			g	Desig.		
−2.000	$^{10}H_{\frac12}$			0.713	$^{8}L_{5\frac12}$			0.937	$^{8}K_{5\frac12}$			1.059	$^{2}L_{8\frac12}$	$^{8}L_{7\frac12}$	
−1.333	$^{8}G_{\frac12}$			0.727	$^{4}I_{4\frac12}$			0.941	$^{2}L_{7\frac12}$			1.060	$^{4}N_{10\frac12}$		
−0.800	$^{10}I_{1\frac12}$			0.737	$^{6}O_{8\frac12}$			0.947	$^{2}M_{8\frac12}$			1.063	$^{10}K_{5\frac12}$		
−0.667	$^{6}F_{\frac12}$			0.738	$^{8}M_{6\frac12}$			0.952	$^{2}N_{9\frac12}$	$^{10}I_{3\frac12}$		1.064	$^{6}Q_{12\frac12}$		
−0.400	$^{8}H_{1\frac12}$			0.761	$^{8}N_{7\frac12}$			0.957	$^{2}O_{10\frac12}$	$^{10}Q_{10\frac12}$		1.067	$^{2}K_{7\frac12}$	$^{6}F_{1\frac12}$	
−0.286	$^{10}K_{2\frac12}$			0.762	$^{6}Q_{9\frac12}$			0.960	$^{2}Q_{11\frac12}$			1.068	$^{4}M_{9\frac12}$		
0.000	$^{4}D_{\frac12}$	$^{6}G_{1\frac12}$	$^{8}I_{2\frac12}$	0.769	$^{4}K_{5\frac12}$			0.962	$^{10}O_{9\frac12}$			1.071	$^{6}H_{4\frac12}$	$^{6}O_{1\frac12}$	
	$^{10}L_{3\frac12}$			0.780	$^{8}O_{8\frac12}$			0.964	$^{4}K_{6\frac12}$			1.073	$^{10}N_{9\frac12}$		
0.182	$^{10}M_{4\frac12}$			0.797	$^{8}Q_{9\frac12}$			0.965	$^{4}I_{5\frac12}$	$^{4}L_{7\frac12}$		1.077	$^{2}I_{6\frac12}$	$^{4}L_{8\frac12}$	
0.222	$^{8}K_{3\frac12}$			0.800	$^{2}D_{1\frac12}$	$^{4}L_{6\frac12}$	$^{10}H_{1\frac12}$	0.966	$^{4}M_{8\frac12}$			1.081	$^{6}N_{10\frac12}$		
0.286	$^{6}H_{2\frac12}$			0.824	$^{4}M_{7\frac12}$			0.967	$^{4}N_{9\frac12}$			1.084	$^{8}Q_{12\frac12}$		
0.308	$^{10}N_{5\frac12}$			0.825	$^{6}H_{3\frac12}$			0.969	$^{4}O_{10\frac12}$			1.087	$^{8}K_{6\frac12}$		
0.364	$^{8}L_{4\frac12}$			0.828	$^{6}I_{4\frac12}$			0.970	$^{4}H_{4\frac12}$	$^{4}Q_{11\frac12}$	$^{8}I_{4\frac12}$	1.090	$^{4}K_{7\frac12}$		
0.400	$^{4}F_{1\frac12}$	$^{10}O_{6\frac12}$		0.831	$^{10}M_{6\frac12}$	$^{10}N_{7\frac12}$		0.972	$^{10}N_{8\frac12}$			1.091	$^{2}H_{5\frac12}$		
0.444	$^{6}I_{3\frac12}$			0.836	$^{10}O_{8\frac12}$			0.984	$^{4}G_{3\frac12}$			1.093	$^{6}M_{9\frac12}$		
0.462	$^{8}M_{5\frac12}$			0.839	$^{6}K_{5\frac12}$	$^{10}L_{5\frac12}$		0.988	$^{6}Q_{11\frac12}$	$^{10}M_{7\frac12}$		1.096	$^{8}O_{11\frac12}$	$^{10}M_{8\frac12}$	
0.471	$^{10}Q_{7\frac12}$			0.842	$^{4}N_{8\frac12}$	$^{10}Q_{9\frac12}$		0.990	$^{6}O_{10\frac12}$			1.108	$^{4}I_{6\frac12}$	$^{6}L_{8\frac12}$	
0.508	$^{10}K_{3\frac12}$			0.851	$^{6}L_{6\frac12}$			0.992	$^{6}N_{9\frac12}$			1.110	$^{8}N_{10\frac12}$		
0.514	$^{10}I_{2\frac12}$			0.857	$^{2}F_{2\frac12}$	$^{4}O_{9\frac12}$	$^{6}G_{2\frac12}$	0.997	$^{6}M_{8\frac12}$			1.111	$^{2}G_{4\frac12}$	$^{4}Q_{13\frac12}$	$^{10}Q_{12\frac12}$
0.533	$^{8}N_{6\frac12}$			0.863	$^{6}M_{7\frac12}$			1.004	$^{6}L_{7\frac12}$			1.120	$^{4}O_{12\frac12}$		
0.545	$^{6}K_{4\frac12}$	$^{10}L_{4\frac12}$		0.869	$^{10}K_{4\frac12}$			1.012	$^{8}Q_{11\frac12}$			1.124	$^{6}Q_{13\frac12}$		
0.571	$^{4}G_{2\frac12}$			0.870	$^{4}Q_{10\frac12}$			1.015	$^{6}K_{6\frac12}$	$^{10}L_{6\frac12}$		1.127	$^{10}O_{11\frac12}$		
0.587	$^{10}M_{5\frac12}$			0.873	$^{6}N_{8\frac12}$			1.019	$^{8}O_{10\frac12}$			1.128	$^{8}M_{9\frac12}$		
0.588	$^{8}O_{7\frac12}$			0.882	$^{6}O_{9\frac12}$			1.028	$^{8}N_{9\frac12}$			1.129	$^{6}K_{7\frac12}$	$^{10}L_{7\frac12}$	
0.615	$^{6}L_{5\frac12}$			0.889	$^{2}G_{3\frac12}$			1.029	$^{4}F_{2\frac12}$			1.130	$^{4}N_{11\frac12}$		
0.626	$^{10}N_{6\frac12}$			0.890	$^{6}Q_{10\frac12}$			1.035	$^{6}I_{5\frac12}$			1.133	$^{4}H_{5\frac12}$	$^{8}I_{5\frac12}$	
0.632	$^{8}Q_{8\frac12}$			0.909	$^{2}H_{4\frac12}$			1.040	$^{2}Q_{12\frac12}$	$^{8}M_{8\frac12}$		1.135	$^{6}O_{12\frac12}$		
0.659	$^{10}O_{7\frac12}$			0.916	$^{8}N_{8\frac12}$			1.043	$^{2}O_{11\frac12}$	$^{10}Q_{11\frac12}$		1.142	$^{8}Q_{13\frac12}$		
0.667	$^{2}P_{\frac12}$	$^{4}H_{3\frac12}$	$^{6}M_{6\frac12}$	0.917	$^{8}O_{9\frac12}$			1.048	$^{2}N_{10\frac12}$	$^{8}H_{3\frac12}$		1.143	$^{2}F_{3\frac12}$	$^{4}M_{10\frac12}$	$^{6}G_{3\frac12}$
	$^{8}I_{3\frac12}$			0.918	$^{8}M_{7\frac12}$			1.049	$^{4}Q_{12\frac12}$			1.147	$^{10}N_{10\frac12}$		
0.686	$^{8}H_{2\frac12}$			0.919	$^{8}Q_{10\frac12}$			1.053	$^{2}M_{9\frac12}$			1.148	$^{6}N_{11\frac12}$		
0.687	$^{8}K_{4\frac12}$	$^{10}Q_{8\frac12}$		0.923	$^{2}I_{5\frac12}$	$^{8}L_{6\frac12}$		1.054	$^{4}O_{11\frac12}$			1.152	$^{8}L_{8\frac12}$	$^{10}I_{4\frac12}$	
0.706	$^{6}N_{7\frac12}$			0.933	$^{2}K_{6\frac12}$	$^{8}G_{1\frac12}$		1.056	$^{10}O_{10\frac12}$			1.156	$^{8}O_{12\frac12}$		

Table 4. Landé g-values for Terms of Even Multiplicity in Order of Increasing g—Continued

g	Desig.	g	Desig.	g	Desig.	g	Desig.
1.158	$^4L_{9\frac12}$	1.255	$^{10}K_{7\frac12}$	1.394	$^{10}H_{4\frac12}$	1.714	$^6P_{3\frac12}$ $^8F_{2\frac12}$
1.159	$^6I_{6\frac12}$	1.257	$^8G_{2\frac12}$	1.397	$^6F_{3\frac12}$	1.733	$^4P_{1\frac12}$
1.164	$^6M_{10\frac12}$	1.259	$^8N_{13\frac12}$ $^{10}I_{5\frac12}$	1.412	$^8H_{8\frac12}$	1.758	$^{10}F_{4\frac12}$
1.165	$^{10}Q_{13\frac12}$	1.261	$^{10}O_{14\frac12}$	1.414	$^8G_{4\frac12}$ $^{10}I_{9\frac12}$	1.762	$^{10}D_{5\frac12}$
1.172	$^4G_{4\frac12}$ $^6Q_{14\frac12}$ $^8N_{11\frac12}$	1.263	$^6K_{9\frac12}$ $^{10}L_{9\frac12}$	1.427	$^{10}H_{5\frac12}$	1.772	$^{10}G_{2\frac12}$
1.173	$^{10}M_{9\frac12}$	1.267	$^8L_{10\frac12}$	1.429	$^4D_{3\frac12}$ $^{10}I_{10\frac12}$	1.778	$^8P_{4\frac12}$
1.176	$^4K_{8\frac12}$	1.273	$^4G_{5\frac12}$ $^6G_{4\frac12}$ $^{10}M_{11\frac12}$	1.434	$^6F_{4\frac12}$	1.809	$^8D_{3\frac12}$
1.179	$^{10}K_{6\frac12}$		$^{10}Q_{16\frac12}$	1.441	$^8G_{5\frac12}$	1.818	$^{10}P_{5\frac12}$
1.182	$^{10}O_{12\frac12}$	1.280	$^8M_{12\frac12}$	1.446	$^{10}H_{6\frac12}$	1.867	$^6D_{1\frac12}$
1.183	$^6L_{9\frac12}$	1.282	$^6H_{6\frac12}$ $^{10}N_{13\frac12}$	1.455	$^6F_{5\frac12}$	1.879	$^{10}D_{4\frac12}$
1.184	$^8K_{7\frac12}$	1.290	$^{10}O_{15\frac12}$	1.456	$^8G_{6\frac12}$	1.886	$^6P_{2\frac12}$
1.185	$^6O_{13\frac12}$	1.294	$^6I_{8\frac12}$ $^8I_{7\frac12}$	1.459	$^{10}H_{7\frac12}$	1.905	$^{10}F_{3\frac12}$
1.188	$^8Q_{14\frac12}$	1.298	$^8K_{9\frac12}$	1.467	$^8G_{7\frac12}$ $^{10}H_{8\frac12}$	1.937	$^8P_{3\frac12}$
1.193	$^8M_{10\frac12}$	1.301	$^8H_{5\frac12}$	1.474	$^{10}H_{9\frac12}$	1.960	$^{10}P_{4\frac12}$
1.200	$^2D_{2\frac12}$ $^4D_{1\frac12}$ $^4I_{7\frac12}$	1.304	$^8L_{11\frac12}$ $^{10}L_{10\frac12}$	1.529	$^{10}G_{8\frac12}$	2.000	$^2S_{\frac12}$ $^4S_{1\frac12}$ $^6S_{2\frac12}$
	$^6N_{12\frac12}$ $^{10}H_{2\frac12}$	1.307	$^{10}K_{8\frac12}$ $^{10}M_{12\frac12}$	1.537	$^{10}G_{7\frac12}$		$^8S_{3\frac12}$ $^8F_{1\frac12}$ $^{10}S_{4\frac12}$
1.203	$^6H_{5\frac12}$ $^8O_{13\frac12}$ $^{10}N_{11\frac12}$	1.310	$^{10}N_{14\frac12}$	1.538	$^8F_{6\frac12}$	2.057	$^8D_{2\frac12}$
1.207	$^6K_{8\frac12}$ $^{10}L_{8\frac12}$	1.314	$^6F_{2\frac12}$	1.549	$^{10}G_{6\frac12}$	2.095	$^{10}D_{3\frac12}$
1.208	$^{10}Q_{14\frac12}$	1.323	$^{10}I_{6\frac12}$	1.552	$^8F_{5\frac12}$	2.133	$^{10}G_{1\frac12}$
1.212	$^8H_{4\frac12}$	1.333	$^2P_{1\frac12}$ $^4F_{4\frac12}$ $^6H_{7\frac12}$	1.556	$^6D_{4\frac12}$	2.222	$^{10}P_{3\frac12}$
1.217	$^6M_{11\frac12}$		$^8K_{10\frac12}$ $^{10}H_{3\frac12}$ $^{10}M_{13\frac12}$	1.566	$^{10}G_{5\frac12}$	2.229	$^{10}F_{2\frac12}$
1.218	$^8L_{9\frac12}$	1.336	$^{10}L_{11\frac12}$	1.576	$^8F_{4\frac12}$	2.286	$^8P_{2\frac12}$
1.221	$^8N_{12\frac12}$	1.337	$^8I_{8\frac12}$	1.587	$^6D_{3\frac12}$	2.400	$^6P_{1\frac12}$
1.226	$^8Q_{15\frac12}$ $^{10}O_{13\frac12}$	1.343	$^6G_{5\frac12}$ $^{10}K_{9\frac12}$	1.596	$^{10}G_{4\frac12}$	2.572	$^{10}D_{2\frac12}$
1.230	$^{10}M_{10\frac12}$	1.354	$^8H_{6\frac12}$	1.600	$^4P_{2\frac12}$ $^{10}F_{7\frac12}$	2.667	$^4P_{\frac12}$
1.231	$^4H_{6\frac12}$ $^8I_{6\frac12}$	1.360	$^{10}L_{12\frac12}$	1.619	$^8F_{3\frac12}$	2.800	$^8D_{1\frac12}$
1.238	$^4F_{3\frac12}$ $^6L_{10\frac12}$	1.365	$^8G_{3\frac12}$ $^{10}I_{7\frac12}$	1.631	$^{10}F_{6\frac12}$	3.200	$^{10}F_{1\frac12}$
1.239	$^6I_{7\frac12}$	1.368	$^8I_{9\frac12}$	1.636	$^8D_{5\frac12}$	3.333	$^6D_{\frac12}$
1.241	$^8O_{14\frac12}$	1.371	$^4D_{2\frac12}$ $^{10}K_{10\frac12}$	1.651	$^{10}G_{3\frac12}$	4.000	$^8F_{\frac12}$
1.242	$^8M_{11\frac12}$	1.385	$^6G_{6\frac12}$	1.657	$^6D_{2\frac12}$	4.667	$^{10}G_{\frac12}$
1.243	$^{10}Q_{15\frac12}$	1.388	$^8H_{7\frac12}$	1.678	$^{10}F_{5\frac12}$		
1.247	$^{10}N_{12\frac12}$	1.391	$^{10}K_{11\frac12}$	1.692	$^{10}D_{6\frac12}$		
1.251	$^8K_{8\frac12}$	1.393	$^{10}I_{8\frac12}$	1.697	$^8D_{4\frac12}$		

TABLE 5. PREDICTED TERMS OF THE Be I ISOELECTRONIC SEQUENCE

Config. $1s^2+$	Predicted Terms
$2s^2$	^1S
$2s(^2S)2p$	{ $^3P^\circ$ $^1P^\circ$
$2p^2$	{ ^1S ^3P ^1D

Config. $1s^2+$	$ns\ (n\geq3)$	$np\ (n\geq3)$	$nd\ (n\geq3)$	$nf\ (n\geq4)$	$ng\ (n\geq5)$	....
$2s(^2S)nx$	^3S ^1S	$^3P^\circ$ $^1P^\circ$	^3D ^1D	$^3F^\circ$ $^1F^\circ$	^3G ^1G	....
$2p(^2P^\circ)nx$	$^3P^\circ$ $^1P^\circ$	$^3S\ ^3P\ ^3D$ / $^1S\ ^1P\ ^1D$	$^3P^\circ\ ^3D^\circ\ ^3F^\circ$ / $^1P^\circ\ ^1D^\circ\ ^1F^\circ$	$^3D\ ^3F\ ^3G$ / $^1D\ ^1F\ ^1G$	$^3F^\circ\ ^3G^\circ\ ^3H^\circ$ / $^1F^\circ\ ^1G^\circ\ ^1H^\circ$	....

TABLE 6. PREDICTED TERMS OF THE B I ISOELECTRONIC SEQUENCE

Config. $1s^2+$	Predicted Terms
$2s^2(^1S)2p$	$^2P^\circ$
$2s\ 2p^2$	{ ^2S ^4P / ^2P ^2D
$2p^3$	{ $^4S^\circ$; $^2P^\circ$ $^2D^\circ$

Config. $1s^2+$	$ns\ (n\geq3)$	$np\ (n\geq3)$	$nd\ (n\geq3)$
$2s^2(^1S)nx$	^2S	$^2P^\circ$	^2D
$2s\ 2p(^3P^\circ)nx$	$^4P^\circ$ $^2P^\circ$	$^4S\ ^4P\ ^4D$ / $^2S\ ^2P\ ^2D$	$^4P^\circ\ ^4D^\circ\ ^4F^\circ$ / $^2P^\circ\ ^2D^\circ\ ^2F^\circ$
$2s\ 2p(^1P^\circ)nx'$	$^2P^\circ$	$^2S\ ^2P\ ^2D$	$^2P^\circ\ ^2D^\circ\ ^2F^\circ$
$2p^2(^3P)nx''$	^4P ^2P	$^4S^\circ\ ^4P^\circ\ ^4D^\circ$ / $^2S^\circ\ ^2P^\circ\ .^2D^\circ$	$^4P\ ^4D\ ^4F$ / $^2P\ ^2D\ ^2F$
$2p^2(^1D)nx'''$	^2D	$^2P^\circ\ ^2D^\circ\ ^2F^\circ$	$^2S\ ^2P\ ^2D\ ^2F\ ^2G$
$2p^2(^1S)nx^{IV}$	^2S	$^2P^\circ$	^2D

Config. $1s^2+$	$nf\ (n\geq4)$	$ng\ (n\geq5)$	....
$2s^2(^1S)nx$	$^2F^\circ$	^2G	....
$2s\ 2p(^3P^\circ)nx$	$^4D\ ^4F\ ^4G$ / $^2D\ ^2F\ ^2G$	$^4F^\circ\ ^4G^\circ\ ^4H^\circ$ / $^2F^\circ\ ^2G^\circ\ ^2H^\circ$	....
$2s\ 2p(^1P^\circ)nx'$	$^2D\ ^2F\ ^2G$	$^2F^\circ\ ^2G^\circ\ ^2H^\circ$	....
$2p^2(^3P)nx''$	$^4D^\circ\ ^4F^\circ\ ^4G^\circ$ / $^2D^\circ\ ^2F^\circ\ ^2G^\circ$	$^4F\ ^4G\ ^4H$ / $^2F\ ^2G\ ^2H$	....
$2p^2(^1D)nx'''$	$^2P^\circ\ ^2D^\circ\ ^2F^\circ\ ^2G^\circ\ ^2H^\circ$	$^2D\ ^2F\ ^2G\ ^2H\ ^2I$	....
$2p^2(^1S)nx^{IV}$	$^2F^\circ$	^2G	....

TABLE 7.—PREDICTED TERMS OF THE C I ISOELECTRONIC SEQUENCE

Config. $1s^2+$	Predicted Terms				
$2s^2\,2p^2$	$\{$ ^1S ^3P ^1D				
$2s\,2p^3$	$\{$ $^5S^\circ$ $^3S^\circ$ $^3P^\circ$ $^3D^\circ$; $^1P^\circ$ $^1D^\circ$				
$2p^4$	$\{$ ^1S ^3P ^1D				

Config. $1s^2+$	$ns\ (n\ge3)$	$np\ (n\ge3)$	$nd\ (n\ge3)$	$nf\ (n\ge4)$	....
$2s^2\,2p(^2P^\circ)nx$	$^3P^\circ$ $^1P^\circ$	$^3S\ ^3P\ ^3D$ / $^1S\ ^1P\ ^1D$	$^3P^\circ\ ^3D^\circ\ ^3F^\circ$ / $^1P^\circ\ ^1D^\circ\ ^1F^\circ$	$^3D\ ^3F\ ^3G$ / $^1D\ ^1F\ ^1G$	....
$2s\,2p^2(^4P)nx$	^5P ^3P	$^5S^\circ\ ^5P^\circ\ ^5D^\circ$ / $^3S^\circ\ ^3P^\circ\ ^3D^\circ$	$^5P\ ^5D\ ^5F$ / $^3P\ ^3D\ ^3F$	$^5D^\circ\ ^5F^\circ\ ^5G^\circ$ / $^3D^\circ\ ^3F^\circ\ ^3G^\circ$	....
$2s\,2p^2(^2D)nx'$	^3D ^1D	$^3P^\circ\ ^3D^\circ\ ^3F^\circ$ / $^1P^\circ\ ^1D^\circ\ ^1F^\circ$	$^3S\ ^3P\ ^3D\ ^3F\ ^3G$ / $^1S\ ^1P\ ^1D\ ^1F\ ^1G$	$^3P^\circ\ ^3D^\circ\ ^3F^\circ\ ^3G^\circ\ ^3H^\circ$ / $^1P^\circ\ ^1D^\circ\ ^1F^\circ\ ^1G^\circ\ ^1H^\circ$	....
$2s\,2p^2(^2S)nx''$	^3S ^1S	$^3P^\circ$ / $^1P^\circ$	^3D / ^1D	$^3F^\circ$ / $^1F^\circ$	....
$2s\,2p^2(^2P)nx'''$	^3P ^1P	$^3S^\circ\ ^3P^\circ\ ^3D^\circ$ / $^1S^\circ\ ^1P^\circ\ ^1D^\circ$	$^3P\ ^3D\ ^3F$ / $^1P\ ^1D\ ^1F$	$^3D^\circ\ ^3F^\circ\ ^3G^\circ$ / $^1D^\circ\ ^1F^\circ\ ^1G^\circ$	....
$2p^3(^4S^\circ)nx^{IV}$	$^5S^\circ$ $^3S^\circ$	^5P / ^3P	$^5D^\circ$ / $^3D^\circ$	^5F / ^3F	....

TABLE 8. PREDICTED TERMS OF THE N I ISOELECTRONIC SEQUENCE

Config. $1s^2+$	Predicted Terms				
$2s^2\,2p^3$	$\{$ $^4S^\circ$ $^2P^\circ$ $^2D^\circ$				
$2s\,2p^4$	$\{$ ^2S ^4P ^2P ^2D				
$2p^5$	$^2P^\circ$				

Config. $1s^2+$	$ns\ (n\ge3)$	$np\ (n\ge3)$	$nd\ (n\ge3)$	$nf\ (n\ge4)$	....
$2s^2\,2p^2(^3P)nx$	^4P ^2P	$^4S^\circ\ ^4P^\circ\ ^4D^\circ$ / $^2S^\circ\ ^2P^\circ\ ^2D^\circ$	$^4P\ ^4D\ ^4F$ / $^2P\ ^2D\ ^2F$	$^4D^\circ\ ^4F^\circ\ ^4G^\circ$ / $^2D^\circ\ ^2F^\circ\ ^2G^\circ$	....
$2s^2\,2p^2(^1D)nx'$	^2D	$^2P^\circ\ ^2D^\circ\ ^2F^\circ$	$^2S\ ^2P\ ^2D\ ^2F\ ^2G$	$^2P^\circ\ ^2D^\circ\ ^2F^\circ\ ^2G^\circ\ ^2H^\circ$	....
$2s^2\,2p^2(^1S)nx''$	^2S	$^2P^\circ$	^2D	$^2F^\circ$	....
$2s\,2p^3(^5S^\circ)nx'''$	$^6S^\circ$ $^4S^\circ$	^6P / ^4P	$^6D^\circ$ / $^4D^\circ$	^6F / ^4F	....
$2s\,2p^3(^3D^\circ)nx^{IV}$	$^4D^\circ$ $^2D^\circ$	$^4P\ ^4D\ ^4F$ / $^2P\ ^2D\ ^2F$	$^4S^\circ\ ^4P^\circ\ ^4D^\circ\ ^4F^\circ\ ^4G^\circ$ / $^2S^\circ\ ^2P^\circ\ ^2D^\circ\ ^2F^\circ\ ^2G^\circ$	$^4P\ ^4D\ ^4F\ ^4G\ ^4H$ / $^2P\ ^2D\ ^2F\ ^2G\ ^2H$	....
$2s\,2p^3(^3P^\circ)nx^{V}$	$^4P^\circ$ $^2P^\circ$	$^4S\ ^4P\ ^4D$ / $^2S\ ^2P\ ^2D$	$^4P^\circ\ ^4D^\circ\ ^4F^\circ$ / $^2P^\circ\ ^2D^\circ\ ^2F^\circ$	$^4D\ ^4F\ ^4G$ / $^2D\ ^2F\ ^2G$	....

TABLE 9. PREDICTED TERMS OF THE O I ISOELECTRONIC SEQUENCE

Config. 1s²+	Predicted Terms		
$2s^2\,2p^4$	$\{\ ^1S \quad ^3P \quad\quad ^1D$		
$2s\,2p^5$	$\{\ ^3P^{\circ} \quad ^1P^{\circ}$		

Config. 1s²+	$ns\ (n\ge 3)$	$np\ (n\ge 3)$	$nd\ (n\ge 3)$
$2s^2\,2p^3(^4S^{\circ})nx$	$^5S^{\circ}$, $^3S^{\circ}$	^5P, ^3P	$^5D^{\circ}$, $^3D^{\circ}$
$2s^2\,2p^3(^2D^{\circ})nx'$	$^3D^{\circ}$, $^1D^{\circ}$	$^3P\ ^1P$ | $^3D\ ^1D$ | $^3F\ ^1F$	$^3S^{\circ}\ ^1S^{\circ}$ | $^3P^{\circ}\ ^1P^{\circ}$ | $^3D^{\circ}\ ^1D^{\circ}$ | $^3F^{\circ}\ ^1F^{\circ}$ | $^3G^{\circ}\ ^1G^{\circ}$
$2s^2\,2p^3(^2P^{\circ})nx''$	$^3P^{\circ}$, $^1P^{\circ}$	$^3S\ ^1S$ | $^3P\ ^1P$ | $^3D\ ^1D$	$^3P^{\circ}\ ^1P^{\circ}$ | $^3D^{\circ}\ ^1D^{\circ}$ | $^3F^{\circ}\ ^1F^{\circ}$
$2s\,2p^4(^4P)nx'''$	^5P, ^3P	$^5S^{\circ}\ ^3S^{\circ}$ | $^5P^{\circ}\ ^3P^{\circ}$ | $^5D^{\circ}\ ^3D^{\circ}$	$^5P\ ^3P$ | $^5D\ ^3D$ | $^5F\ ^3F$
$2s\,2p^4(^2D)nx^{IV}$	^3D, ^1D	$^3P^{\circ}\ ^1P^{\circ}$ | $^3D^{\circ}\ ^1D^{\circ}$ | $^3F^{\circ}\ ^1F^{\circ}$	$^3S\ ^1S$ | $^3P\ ^1P$ | $^3D\ ^1D$ | $^3F\ ^1F$ | $^3G\ ^1G$
$2s\,2p^4(^2S)nx^{V}$	^3S, ^1S	$^3P^{\circ}$, $^1P^{\circ}$	^3D, ^1D
$2s\,2p^4(^2P)nx^{VI}$	^3P, ^1P	$^3S^{\circ}\ ^1S^{\circ}$ | $^3P^{\circ}\ ^1P^{\circ}$ | $^3D^{\circ}\ ^1D^{\circ}$	$^3P\ ^1P$ | $^3D\ ^1D$ | $^3F\ ^1F$

Config. 1s²+	$nf\ (n\ge 4)$	....
$2s^2\,2p^3(^4S^{\circ})nx$	^5F, ^3F	....
$2s^2\,2p^3(^2D^{\circ})nx'$	$^3P\ ^1P$ | $^3D\ ^1D$ | $^3F\ ^1F$ | $^3G\ ^1G$ | $^3H\ ^1H$	....
$2s^2\,2p^3(^2P^{\circ})nx''$	$^3D\ ^1D$ | $^3F\ ^1F$ | $^3G\ ^1G$	....
$2s\,2p^4(^4P)nx'''$	$^5D^{\circ}\ ^3D^{\circ}$ | $^5F^{\circ}\ ^3F^{\circ}$ | $^5G^{\circ}\ ^3G^{\circ}$	....
$2s\,2p^4(^2D)nx^{IV}$	$^3P^{\circ}\ ^1P^{\circ}$ | $^3D^{\circ}\ ^1D^{\circ}$ | $^3F^{\circ}\ ^1F^{\circ}$ | $^3G^{\circ}\ ^1G^{\circ}$ | $^3H^{\circ}\ ^1H^{\circ}$	....
$2s\,2p^4(^2S)nx^{V}$	$^3F^{\circ}$, $^1F^{\circ}$	....
$2s2p^4(^2P)nx^{VI}$	$^3D^{\circ}\ ^1D^{\circ}$ | $^3F^{\circ}\ ^1F^{\circ}$ | $^3G^{\circ}\ ^1G^{\circ}$	....

TABLE 10. PREDICTED TERMS OF THE F I ISOELECTRONIC SEQUENCE

Config. 1s²+	Predicted Terms					
2s² 2p⁵	²P°					
2s 2p⁶	²S					

Config. 1s²+	ns (n≥3)	np (n≥3)			nd (n≥3)			
2s² 2p⁴(³P)nx {	⁴P / ²P	⁴S° / ²S°	⁴P° / ²P°	⁴D° / ²D°	⁴P / ²P	⁴D / ²D	⁴F / ²F	
2s² 2p⁴(¹D)nx′	²D		²P°	²D°	²F°	²S ²P	²D	²F	²G
2s² 2p⁴(¹S)nx″	²S		²P°			²D			
2s 2p⁵(³P°)nx‴ {	⁴P° / ²P°	⁴S / ²S	⁴P / ²P	⁴D / ²D	⁴P° / ²P°	⁴D° / ²D°	⁴F° / ²F°	

Config. 1s²+	nf (n≥4)					....
2s² 2p⁴(³P)nx {	⁴D° / ²D°	⁴F° / ²F°	⁴G° / ²G°			....
2s² 2p⁴(¹D)nx′	²P°	²D°	²F°	²G°	²H°	....
2s² 2p⁴(¹S)nx″		²F°				....
2s 2p⁵(³P°)nx‴ {	⁴D / ²D	⁴F / ²F	⁴G / ²G			....

TABLE 11. PREDICTED LEVELS OF THE Ne I ISOELECTRONIC SEQUENCE

Config. 1s²+	Predicted Terms												
2s² 2p⁶	¹S												

Config. 1s²+	ns (n≥3)	np (n≥3)			nd (n≥3)			nf (n≥4)			....
2s² 2p⁵(²P°)nx {	³P° / ¹P°	³S / ¹S	³P / ¹P	³D / ¹D	³P° / ¹P°	³D° / ¹D°	³F° / ¹F°	³D / ¹D	³F / ¹F	³G / ¹G	....
2s 2p⁶(²S)nx {	³S / ¹S		³P° / ¹P°			³D / ¹D			³F° / ¹F°		....

jl-Coupling Notation

Config. 1s² 2s²+	Predicted Pairs				
	ns (n≥3)	np (n≥3)	nd (n≥3)	nf (n≥4)	....
2p⁵(²P°₁½)nx	[1½]°	[½] [2½] [1½]	[½]° [3½]° [1½]° [2½]°	[1½] [4½] [2½] [3½]	....
2p⁵(²P°½)nx′	[½]°	[1½] [½]	[2½]° [1½]°	[3½] [2½]	....

TABLE 12. PREDICTED TERMS OF THE Mg I ISOELECTRONIC SEQUENCE

Config. $1s^2\,2s^2\,2p^6+$	Predicted Terms			
$3s^2$	¹S			
$3s(^2S)3p$	{ ³P° ¹P°			
$3p^2$	{ ¹S ³P ¹D			
	$ns\ (n\geq 4)$	**$np\ (n\geq 4)$**	**$nd\ (n\geq 3)$**	
$3s(^2S)nx$	{ ³S ¹S	³P° ¹P°	³D ¹D	
$3p(^2P°)nx$	{ ³P° ¹P°	³S ¹S ³P ¹P ³D ¹D	³P° ¹P° ³D° ¹D° ³F° ¹F°	
	$n_f\ (n\geq 4)$	**$ng\ (n\geq 5)$**	**$nh\ (n\geq 6)$**	....
$3s(^2S)nx$	{ ³F° ¹F°	³G ¹G	³H° ¹H°	....
$3p(^2P°)nx$	{ ³D ¹D ³F ¹F ³G ¹G	³F° ¹F° ³G° ¹G° ³H° ¹H°	³G ¹G ³H ¹H ³I ¹I	....

TABLE 13. PREDICTED TERMS OF THE Al I ISOELECTRONIC SEQUENCE

Config. $1s^2\,2s^2\,2p^6+$	Predicted Terms					
$3s^2(^1S)3p$	²P°					
$3s\,3p^2$	{ ²S ⁴P ²P ²D					
$3p^3$	{ ⁴S° ²P° ²D°					
	$ns\ (n\geq 4)$	**$np\ (n\geq 4)$**	**$nd\ (n\geq 3)$**	**$nf\ (n\geq 4)$**	**$ng\ (n\geq 5)$**	....
$3s^2(^1S)nx$	²S	²P°	²D	²F°	²G	....
$3s\,3p(^3P°)nx$	{ ⁴P° ²P°	⁴S ²S ⁴P ²P ⁴D ²D	⁴P° ²P° ⁴D° ²D° ⁴F° ²F°	⁴D ²D ⁴F ²F° ⁴G ²G	⁴F° ²F° ⁴G° ²G° ⁴H° ²H°	....
$3s\,3p(^1P°)nx'$	²P°	²S ²P ²D	²P° ²D° ²F°	²D ²F ²G	²F° ²G° ²H°	....

TABLE 14. PREDICTED TERMS OF THE Si I ISOELECTRONIC SEQUENCE

Config. $1s^2\,2s^2\,2p^6+$	Predicted Terms		
$3s^2\,3p^2$	^1S	^3P	^1D
$3s\,3p^3$	$^5S^\circ$ $^3S^\circ$	$^3P^\circ$	$^3D^\circ$
	$^1P^\circ$	$^1D^\circ$	
$3p^4$	^1S	^3P	^1D

Config.	$ns\ (n\geq4)$	$np\ (n\geq4)$	$nd\ (n\geq3)$	$nf\ (n\geq4)$	
$3s^2\,3p(^2P^\circ)nx$	$^3P^\circ$ $^1P^\circ$	^3S ^3P ^3D / ^1S ^1P ^1D	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$ / $^1P^\circ$ $^1D^\circ$ $^1F^\circ$	^3D ^3F ^3G / ^1D ^1F ^1G	....
$3s\,3p^2(^4P)nx$	^5P ^3P	$^5S^\circ$ $^5P^\circ$ $^5D^\circ$ / $^3S^\circ$ $^3P^\circ$ $^3D^\circ$	^5P ^5D ^5F / ^3P ^3D ^3F	$^5D^\circ$ $^5F^\circ$ $^5G^\circ$ / $^3D^\circ$ $^3F^\circ$ $^3G^\circ$	....

TABLE 15. PREDICTED TERMS OF THE P I ISOELECTRONIC SEQUENCE

Config. $1s^2\,2s^2\,2p^6+$	Predicted Terms		
$3s^2\,3p^3$	$^4S^\circ$	$^2P^\circ$	$^2D^\circ$
$3s\,3p^4$	^2S	^4P ^2P	^2D
$3p^5$	$^2P^\circ$		

Config.	$ns\ (n\geq4)$	$np\ (n\geq4)$	$nd\ (n\geq3)$	$nf\ (n\geq4)$	
$3s^2\,3p^2(^3P)nx$	^4P ^2P	$^4S^\circ$ $^4P^\circ$ $^4D^\circ$ / $^2S^\circ$ $^2P^\circ$ $^2D^\circ$	^4P ^4D ^4F / ^2P ^2D ^2F	$^4D^\circ$ $^4F^\circ$ $^4G^\circ$ / $^2D^\circ$ $^2F^\circ$ $^2G^\circ$	....
$3s^2\,3p^2(^1D)nx'$	^2D	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^2S ^2P ^2D ^2F ^2G	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$ $^2H^\circ$	....
$3s^2\,3p^2(^1S)nx''$	^2S	$^2P^\circ$	^2D	$^2F^\circ$	....

TABLE 16. PREDICTED TERMS OF THE S I ISOELECTRONIC SEQUENCE

Config. 1s² 2s² 2p⁶+	Predicted Terms				
$3s^2\,3p^4$	^1S $\quad$ ^3P $\quad$ ^1D				
$3s\,3p^5$	$^3P^\circ$ $\quad$ $^1P^\circ$				

Config. 1s² 2s² 2p⁶+	ns (n≥4)	np (n≥4)	nd (n≥3)	nf (n≥4)	....
$3s^2\,3p^3(^4S^\circ)nx$	$^5S^\circ$	^5P	$^5D^\circ$	^5F	....
	$^3S^\circ$	^3P	$^3D^\circ$	^3F	....
$3s^2\,3p^3(^2D^\circ)nx'$	$^3D^\circ$	^3P ^3D ^3F	$^3S^\circ$ $^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^3G^\circ$	^3P ^3D ^3F ^3G ^3H	....
	$^1D^\circ$	^1P ^1D ^1F	$^1S^\circ$ $^1P^\circ$ $^1D^\circ$ $^1F^\circ$ $^1G^\circ$	^1P ^1D ^1F ^1G ^1H	....
$3s^2\,3p^3(^2P^\circ)nx''$	$^3P^\circ$ ^3S ^3P ^3D		$^3P^\circ$ $^3D^\circ$ $^3F^\circ$	^3D ^3F ^3G	....
	$^1P^\circ$ ^1S ^1P ^1D		$^1P^\circ$ $^1D^\circ$ $^1F^\circ$	^1D ^1F ^1G	....
$3s\,3p^4(^4P)nx'''$	^5P	$^5S^\circ$ $^5P^\circ$ $^5D^\circ$	^5P ^5D ^5F	$^5D^\circ$ $^5F^\circ$ $^5G^\circ$	....
	^3P	$^3S^\circ$ $^3P^\circ$ $^3D^\circ$	^3P ^3D ^3F	$^3D^\circ$ $^3F^\circ$ $^3G^\circ$	....
$3s\,3p^4(^2D)nx^{IV}$	^3D	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$	^3S ^3P ^3D ^3F ^3G	$^3P^\circ$ $^3D^\circ$ $^3F^\circ$ $^3G^\circ$ $^3H^\circ$	....
	^1D	$^1P^\circ$ $^1D^\circ$ $^1F^\circ$	^1S ^1P ^1D ^1F ^1G	$^1P^\circ$ $^1D^\circ$ $^1F^\circ$ $^1G^\circ$ $^1H^\circ$	....
$3s\,3p^4(^2S)nx^{V}$	^3S	$^3P^\circ$	^3D	$^3F^\circ$	....
	^1S	$^1P^\circ$	^1D	$^1F^\circ$	....
$3s\,3p^4(^2P)nx^{VI}$	^3P	$^3S^\circ$ $^3P^\circ$ $^3D^\circ$	^3P ^3D ^3F	$^3D^\circ$ $^3F^\circ$ $^3G^\circ$	....
	^1P	$^1S^\circ$ $^1P^\circ$ $^1D^\circ$	^1P ^1D ^1F	$^1D^\circ$ $^1F^\circ$ $^1G^\circ$	....
$3p^5(^2P^\circ)nx^{VII}$	$^3P^\circ$ ^3S ^3P ^3D		$^3P^\circ$ $^3D^\circ$ $^3F^\circ$	^3D ^3F ^3G	....
	$^1P^\circ$ ^1S ^1P ^1D		$^1P^\circ$ $^1D^\circ$ $^1F^\circ$	^1D ^1F ^1G	....

TABLE 17. PREDICTED TERMS OF THE Cl I ISOELECTRONIC SEQUENCE

Config. 1s² 2s² 2p⁶+	Predicted Terms				
$3s^2\,3p^5$	$^2P^\circ$				
$3s\,3p^6$	^2S				

Config. 1s² 2s² 2p⁶+	ns (n≥4)	np (n≥4)	nd (n≥3)	nf (n≥4)	....
$3s^2\,3p^4(^3P)nx$	^4P	$^4S^\circ$ $^4P^\circ$ $^4D^\circ$	^4P ^4D ^4F	$^4D^\circ$ $^4F^\circ$ $^4G^\circ$	....
	^2P	$^2S^\circ$ $^2P^\circ$ $^2D^\circ$	^2P ^2D ^2F	$^2D^\circ$ $^2F^\circ$ $^2G^\circ$	....
$3s^2\,3p^4(^1D)nx'$	^2D	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^2S ^2P ^2D ^2F ^2G	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$ $^2G^\circ$ $^2H^\circ$	....
$3s^2\,3p^4(^1S)nx''$	^2S	$^2P^\circ$	^2D	$^2F^\circ$	....
$3s\,3p^5(^3P^\circ)nx'''$	$^4P^\circ$	^4S ^4P ^4D	$^4P^\circ$ $^4D^\circ$ $^4F^\circ$	^4D ^4F ^4G	....
	$^2P^\circ$	^2S ^2P ^2D	$^2P^\circ$ $^2D^\circ$ $^2F^\circ$	^2D ^2F ^2G	....

TABLE 18. PREDICTED LEVELS OF THE A I ISOELECTRONIC SEQUENCE

Config. $1s^2\,2s^2\,2p^6+$	Predicted Terms										
$3s^2\,3p^6$	^1S										
	$ns\ (n\geq4)$		$np\ (n\geq4)$			$nd\ (n\geq3)$			$nf\ (n\geq4)$			....
$3s^2\,3p^5(^2P^\circ)nx$	$^3P^\circ$ $^1P^\circ$		^3S ^1S	^3P ^1P	^3D ^1D	$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$	^3D ^1D	^3F ^1F	^3G ^1G	....
$3s\,3p^6(^2S)nx$	^3S ^1S		$^3P^\circ$ $^1P^\circ$			^3D ^1D			$^3F^\circ$ $^1F^\circ$			....

jl-Coupling Notation

Config. $1s^2\,2s^2\,2p^6\,3s^2+$	Predicted Pairs				
	$ns\ (n\geq4)$	$np\ (n\geq4)$	$nd\ (n\geq3)$	$nf\ (n\geq4)$	....
$3p^5(^2P^\circ_{1\frac12})nx$	$[1\frac12]^\circ$	$[\frac12]$ $[2\frac12]$ $[1\frac12]$	$[\frac12]^\circ$ $[3\frac12]^\circ$ $[1\frac12]^\circ$ $[2\frac12]^\circ$	$[1\frac12]$ $[4\frac12]$ $[2\frac12]$ $[3\frac12]$	....
$3p^5(^2P^\circ_{\frac12})nx'$	$[\frac12]^\circ$	$[1\frac12]$ $[\frac12]$	$[2\frac12]^\circ$ $[1\frac12]^\circ$	$[3\frac12]$ $[2\frac12]$	....

TABLE 19. PREDICTED TERMS OF THE Ca I ISOELECTRONIC SEQUENCE

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Predicted Terms									
$4s^2$	^1S									
$3d^2$	^1S	^3P	^1D	^3F	^1G					
$4p^2$	^1S	^3P	^1D							
	$ns\ (n\geq4)$			$np\ (n\geq4)$			$nd\ (n\geq3)$			
$4s(^2S)nx$	^3S ^1S			$^3P^\circ$ $^1P^\circ$			^3D ^1D			
$3d(^2D)nx'$	^3D ^1D			$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$	^3S ^1S	^3P ^1P	^3D ^1D	^3F ^1F ^3G ^1G
$4p(^2P^\circ)nx''$	$^3P^\circ$ $^1P^\circ$			^3S ^1S	^3P ^1P	^3D ^1D	$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$	
	$nf\ (n\geq4)$					$ng\ (n\geq5)$				....
$4s(^2S)nx$	$^3F^\circ$ $^1F^\circ$					^3G ^1G				....
$3d(^2D)nx'$	$^3P^\circ$ $^1P^\circ$	$^3D^\circ$ $^1D^\circ$	$^3F^\circ$ $^1F^\circ$	$^3G^\circ$ $^1G^\circ$	$^3H^\circ$ $^1H^\circ$	^3D ^1D	^3F ^1F	^3G ^1G	^3H ^1H	^3I ^1I ....
$4p(^2P^\circ)nx''$	^3D ^1D	^3F ^1F	^3G ^1G			$^3F^\circ$ $^1F^\circ$	$^3G^\circ$ $^1G^\circ$	$^3H^\circ$ $^1H^\circ$		....

TABLE 20. PREDICTED TERMS OF THE Sc I ISOELECTRONIC SEQUENCE

Config. 1s² 2s² 2p⁶ 3s² 3p⁶+	Predicted Terms					
$3d\,4s^2$	^2D					
$3d^3$	^4P ^2P	^2D ^2D	^4F ^2F	^2G	^2H	

	$ns\ (n\ge 4)$			$np\ (n\ge 4)$		
$3d\,4s(^3D)nx$	^4D ^2D			$^4P°$ $^2P°$	$^4D°$ $^2D°$	$^4F°$ $^2F°$
$3d\,4s(^1D)nx$	^2D			$^2P°$	$^2D°$	$^2F°$
$3d^2(^3F)nx$	^4F ^2F			$^4D°$ $^2D°$	$^4F°$ $^2F°$	$^4G°$ $^2G°$
$3d^2(^1D)nx$	^2D			$^2P°$	$^2D°$	$^2F°$
$3d^2(^1S)nx$	^2S			$^2P°$		
$3d^2(^3P)nx$	^4P ^2P			$^4S°$ $^2S°$	$^4P°$ $^2P°$	$^4D°$ $^2D°$
$3d^2(^1G)nx$		^2G			$^2F°$ $^2G°$	$^2H°$
$4p^2(^3P)nx$	^4P ^2P			$^4S°$ $^2S°$	$^4P°$ $^2P°$	$^4D°$ $^2D°$

	$nd\ (n\ge 3)$					$nf\ (n\ge 4)$					
$3d\,4s(^3D)nx$	^4S ^2S	^4P ^2P	^4D ^2D	^4F ^2F	^4G ^2G	$^4P°$ $^2P°$	$^4D°$ $^2D°$	$^4F°$ $^2F°$	$^4G°$ $^2G°$	$^4H°$ $^2H°$	....
$3d\,4s(^1D)nx$	^2S	^2P	^2D	^2F	^2G	$^2P°$	$^2D°$	$^2F°$	$^2G°$	$^2H°$	....
$3d^2(^3F)nx$	^4P ^2P	^4D ^2D	^4F ^2F	^4G ^2G	^4H ^2H	$^4D°$ $^2D°$	$^4F°$ $^2F°$	$^4G°$ $^2G°$	$^4H°$ $^2H°$	$^4I°$ $^2I°$	....
$3d^2(^1D)nx$	^2S	^2P	^2D	^2F	^2G	$^2P°$	$^2D°$	$^2F°$	$^2G°$	$^2H°$	....
$3d^2(^1S)nx$		^2D					$^2F°$				....
$3d^2(^3P)nx$	^4P ^2P	^4D ^2D	^4F ^2F			$^4D°$ $^2D°$	$^4F°$ $^2F°$	$^4G°$ $^2G°$			....
$3d^2(^1G)nx$		^2D	^2F	^2G	^2H $\quad^2I$		$^2F°$	$^2G°$	$^2H°$	$^2I°\quad^2K°$	....
$4p^2(^3P)nx$	^4P ^2P	^4D ^2D	^4F ^2F			$^4D°$ $^2D°$	$^4F°$ $^2F°$	$^4G°$ $^2G°$			....

TABLE 21. PREDICTED TERMS OF THE Ti I ISOELECTRONIC SEQUENCE

Predicted Terms

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,+$	Terms
$3d^2\,4s^2$	^1S ^3P ^1D ^3F ^1G
$3d^4$	$\{^1S,\,^1S\}$ $\{^3P,\,^3P\}$ $^5D/^3D$ $^3F/^3F$ $^1D/^1D$ $^3G/^1G$ ^3H ^1I

Config.	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 4)$
$3d^2\,4s(^4F)nx$	$^5F/^3F$	$^5D^\circ/^3D^\circ$, $^5F^\circ/^3F^\circ$, $^5G^\circ/^3G^\circ$	$^5P/^3P$, $^5D/^3D$, $^5F/^3F$, $^5G/^3G$, $^5H/^3H$
$3d^3(^4F)nx$	$^5F/^3F$	$^5D^\circ/^3D^\circ$, $^5F^\circ/^3F^\circ$, $^5G^\circ/^3G^\circ$	$^5P/^3P$, $^5D/^3D$, $^5F/^3F$, $^5G/^3G$, $^5H/^3H$
$3d^2\,4s(^2F)nx$	$^3F/^1F$	$^3D^\circ/^1D^\circ$, $^3F^\circ/^1F^\circ$, $^3G^\circ/^1G^\circ$	$^3P/^1P$, $^3D/^1D$, $^3F/^1F$, $^3G/^1G$, $^3H/^1H$
$3d^2\,4s(^2D)nx$	$^3D/^1D$	$^3P^\circ/^1P^\circ$, $^3D^\circ/^1D^\circ$, $^3F^\circ/^1F^\circ$	$^3S/^1S$, $^3P/^1P$, $^3D/^1D$, $^3F/^1F$, $^3G/^1G$, $^3H/^1H$
$3d^3(^2G)nx$	$^3G/^1G$	$^3F^\circ/^1F^\circ$, $^3G^\circ/^1G^\circ$, $^3H^\circ/^1H^\circ$	$^3P/^1P$, $^3D/^1D$, $^3F/^1F$, $^3G/^1G$, $^3H/^1H$, $^3I/^1I$
$3d^3(^4P)nx$	$^5P/^3P$	$^5S^\circ/^3S^\circ$, $^5P^\circ/^3P^\circ$, $^5D^\circ/^3D^\circ$	$^5P/^3P$, $^5D/^3D$, $^5F/^3F$
$3d^3(^2P)nx$	$^3P/^1P$	$^3S^\circ/^1S^\circ$, $^3P^\circ/^1P^\circ$, $^3D^\circ/^1D^\circ$	$^3P/^1P$, $^3D/^1D$, $^3F/^1F$
$3d^2\,4s(^4P)nx$	$^5P/^3P$	$^5S^\circ/^3S^\circ$, $^5P^\circ/^3P^\circ$, $^5D^\circ/^3D^\circ$	$^5P/^3P$, $^5D/^3D$, $^5F/^3F$
$3d^3(^2D)nx$	$^3D/^1D$	$^3P^\circ/^1P^\circ$, $^3D^\circ/^1D^\circ$, $^3F^\circ/^1F^\circ$	$^3P/^1P$, $^3D/^1D$, $^3F/^1F$, $^3G/^1G$, $^3H/^1H$
$3d^3(^2H)nx$	$^3H/^1H$	$^3G^\circ/^1G^\circ$, $^3H^\circ/^1H^\circ$, $^3I^\circ/^1I^\circ$	$^3F/^1F$, $^3G/^1G$, $^3H/^1H$, $^3I/^1I$, $^3K/^1K$
$3d^2\,4s(^2G)nx$	$^3G/^1G$	$^3F^\circ/^1F^\circ$, $^3G^\circ/^1G^\circ$, $^3H^\circ/^1H^\circ$	$^3P/^1P$, $^3D/^1D$, $^3F/^1F$, $^3G/^1G$, $^3H/^1H$, $^3I/^1I$
$3d^2\,4s(^2P)nx$	$^3P/^1P$	$^3S^\circ/^1S^\circ$, $^3P^\circ/^1P^\circ$, $^3D^\circ/^1D^\circ$	$^3P/^1P$, $^3D/^1D$, $^3F/^1F$, $^3G/^1G$, $^3H/^1H$
$3d^3(^2F)nx$	$^3F/^1F$	$^3D^\circ/^1D^\circ$, $^3F^\circ/^1F^\circ$, $^3G^\circ/^1G^\circ$	$^3D/^1D$, $^3F/^1F$, $^3G/^1G$, $^3H/^1H$
$3d^3\,4s(^2S)nx$	$^3S/^1S$	$^3P^\circ/^1P^\circ$	$^3D/^1D$
$3d\,4s^2(^2D)nx$	$^3D/^1D$	$^3P^\circ/^1P^\circ$, $^3D^\circ/^1D^\circ$, $^3F^\circ/^1F^\circ$	$^3S/^1S$, $^3P/^1P$, $^3D/^1D$, $^3F/^1F$, $^3G/^1G$, $^3H/^1H$

TABLE 22. PREDICTED TERMS OF THE V I ISOELECTRONIC SEQUENCE

Predicted Terms

Top configurations:

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	S	P	D	F	G	H	I
$3d^3\,4s^2$		^4P, ^2P	^2D, ^2D	^4F, ^2F	^2G	^2H	
$3d^5$	^6S, ^2S	^4P, ^2P	^4D, ^2D, ^2D	^4F, ^2F	^4G, ^2G, ^2G	^2H	^2I
$3d^3\,4p^2$ †	^6S, ^4S, ^2S	^6P, ^4P, ^2P	$^6D^*$, $^4D^*$, $^2D^*$	^6F, ^4F, ^2F	^6G, ^4G, ^2G		

Lower configurations:

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 4)$
$3d^4(^5D)nx$	^6D, ^4D	$^6P^\circ,^4P^\circ$; $^6D^\circ,^4D^\circ$; $^6F^\circ,^4F^\circ$; $^6G^\circ,^4G^\circ$	$^6S,^4S$; $^6P,^4P$; $^6D,^4D$; $^6F,^4F$; $^6G,^4G$
$3d^3\,4s(^5F)nx$	^6F, ^4F	$^6D^\circ,^4D^\circ$; $^6F^\circ,^4F^\circ$; $^6G^\circ,^4G^\circ$	$^6P,^4P$; $^6D,^4D$; $^6F,^4F$; $^6G,^4G$; $^6H,^4H$
$3d^3\,4s(^3F)nx$	^4F, ^2F	$^4D^\circ,^2D^\circ$; $^4F^\circ,^2F^\circ$; $^4G^\circ,^2G^\circ$	$^4P,^2P$; $^4D,^2D$; $^4F,^2F$; $^4G,^2G$; $^4H,^2H$
$3d^4(^3P)nx$	^4P, ^2P	$^4S^\circ,^2S^\circ$; $^4P^\circ,^2P^\circ$; $^4D^\circ,^2D^\circ$	$^4P,^2P$; $^4D,^2D$; $^4F,^2F$
$3d^4(^3H)nx$	^4H, ^2H	$^4G^\circ,^2G^\circ$; $^4H^\circ,^2H^\circ$; $^4I^\circ,^2I^\circ$	$^4F,^2F$; $^4G,^2G$; $^4H,^2H$; $^4I,^2I$; $^4K,^2K$
$3d^4(^3F)nx$	^4F, ^2F	$^4D^\circ,^2D^\circ$; $^4F^\circ,^2F^\circ$; $^4G^\circ,^2G^\circ$	$^4P,^2P$; $^4D,^2D$; $^4F,^2F$; $^4G,^2G$; $^4H,^2H$

Even terms (first group)

Configuration	S	P	D	F	G	H	I
$3d^3\,4s(^5P)nx$		$^6P\ ^4P$					
$3d^4(^3G)nx$					$^4G\ ^2G$		
$3d^3\,4s(^3G)nx$					$^4G\ ^2G$		
$3d^4(^1G)nx$					^2G		
$3d^4(^3D)nx$			$^4D\ ^2D$				
$3d^3\,4s(^1G)nx$					^2G		
$3d^3\,4s(^3P)nx$		$^4P\ ^2P$					
$3d^4(^1I)nx$							^2I
$3d^4(^1S)nx$	^2S						
$3d^3\,4s(^3H)nx$			$^4D\ ^2D$			$^4H\ ^2H$	
$3d^3\,4s(^3D)nx$			$^4D\ ^2D$				
$3d^4(^1D)nx$			^2D				
$3d^3\,4s(^1P)nx$		^2P					
$3d^3\,4s(^1H)nx$						^2H	
$3d^3\,4s(^1D)nx$			^2D				
$3d^4(^1F)nx$				^2F			

Odd terms

Configuration	S°	P°	D°	F°	G°	H°	I°	K°
$3d^3\,4s(^5P)nx$	$^6S^\circ\ ^4S^\circ$	$^6P^\circ\ ^4P^\circ$	$^6D^\circ\ ^4D^\circ$					
$3d^4(^3G)nx$				$^4F^\circ\ ^2F^\circ$	$^4G^\circ\ ^2G^\circ$	$^4H^\circ\ ^2H^\circ$		
$3d^3\,4s(^3G)nx$				$^4F^\circ\ ^2F^\circ$	$^4G^\circ\ ^2G^\circ$	$^4H^\circ\ ^2H^\circ$		
$3d^4(^1G)nx$				$^2F^\circ$	$^2G^\circ$	$^2H^\circ$		
$3d^4(^3D)nx$	$^4S^\circ\ ^2S^\circ$	$^4P^\circ\ ^2P^\circ$	$^4D^\circ\ ^2D^\circ$	$^4F^\circ\ ^2F^\circ$	$^4G^\circ\ ^2G^\circ$	$^4H^\circ\ ^2H^\circ$		
$3d^3\,4s(^1G)nx$				$^2F^\circ$	$^2G^\circ$	$^2H^\circ$		
$3d^3\,4s(^3P)nx$		$^4P^\circ\ ^2P^\circ$	$^4D^\circ\ ^2D^\circ$					
$3d^4(^1I)nx$						$^2H^\circ$	$^2I^\circ$	$^2K^\circ$
$3d^4(^1S)nx$		$^2P^\circ$						
$3d^3\,4s(^3H)nx$				$^4F^\circ\ ^2F^\circ$	$^4G^\circ\ ^2G^\circ$	$^4H^\circ\ ^2H^\circ$	$^4I^\circ\ ^2I^\circ$	
$3d^3\,4s(^3D)nx$		$^4P^\circ\ ^2P^\circ$	$^4D^\circ\ ^2D^\circ$	$^4F^\circ\ ^2F^\circ$	$^4G^\circ\ ^2G^\circ$			
$3d^4(^1D)nx$			$^2D^\circ$					
$3d^3\,4s(^1P)nx$	$^2S^\circ$	$^2P^\circ$	$^2D^\circ$					
$3d^3\,4s(^1H)nx$			$^2D^\circ$		$^2G^\circ$	$^2H^\circ$	$^2I^\circ$	
$3d^3\,4s(^1D)nx$				$^2F^\circ$				
$3d^4(^1F)nx$			$^2D^\circ$	$^2F^\circ$	$^2G^\circ$			

Even terms (second group)

Configuration	S	P	D	F	G	H	I	K	L
$3d^3\,4s(^5P)nx$		$^6P\ ^4P$	$^6D\ ^4D$	$^6F\ ^4F$					
$3d^4(^3G)nx$		$^4P\ ^2P$	$^4D\ ^2D$	$^4F\ ^2F$	$^4G\ ^2G$	$^4H\ ^2H$	$^4I\ ^2I$		
$3d^3\,4s(^3G)nx$		$^4P\ ^2P$	$^4D\ ^2D$	$^4F\ ^2F$	$^4G\ ^2G$	$^4H\ ^2H$	$^4I\ ^2I$		
$3d^4(^1G)nx$			^2D	^2F	^2G	^2H	^2I		
$3d^4(^3D)nx$	$^4S\ ^2S$	$^4P\ ^2P$	$^4D\ ^2D$	$^4F\ ^2F$	$^4G\ ^2G$				
$3d^3\,4s(^1G)nx$				^2F	^2G				
$3d^3\,4s(^3P)nx$		$^4P\ ^2P$	$^4D\ ^2D$	$^4F\ ^2F$					
$3d^4(^1I)nx$					^2G	^2H	^2I	^2K	^2L
$3d^4(^1S)nx$			^2D						
$3d^3\,4s(^3H)nx$		$^4P\ ^2P$	$^4D\ ^2D$	$^4F\ ^2F$	$^4G\ ^2G$	$^4H\ ^2H$	$^4I\ ^2I$	$^4K\ ^2K$	
$3d^3\,4s(^3D)nx$	$^4S\ ^2S$	$^4P\ ^2P$	$^4D\ ^2D$	$^4F\ ^2F$	$^4G\ ^2G$	$^4H\ ^2H$	$^4I\ ^2I$		
$3d^4(^1D)nx$	^2S	^2P	^2D	^2F	^2G				
$3d^3\,4s(^1P)nx$		^2P	^2D	^2F					
$3d^3\,4s(^1H)nx$				^2F	^2G	^2H	^2I	^2K	
$3d^3\,4s(^1D)nx$			^2D	^2F	^2G				
$3d^4(^1F)nx$			^2D	^2F	^2G	^2H			

†Incomplete—only limits of higher multiplicity considered.
*Two terms of this type predicted.

Table 23. The Chemical Elements—Ionization Potentials*

Z	Element	Symbol	I. P.	Ground State	Z	Element	Symbol	I. P.	Ground State
1	Hydrogen	H	13.595	$1s$ $\ ^2S_{1/2}$	36	Krypton	Kr	13.996	$(4s^2\ 4p^6)$ $\ ^1S_0$
2	Helium	He	24.580	$(1s^2)$ $\ ^1S_0$	37	Rubidium	Rb	4.176	$5s$ $\ ^2S_{1/2}$
3	Lithium	Li	5.390	$2s$ $\ ^2S_{1/2}$	38	Strontium	Sr	5.692	$5s^2$ $\ ^1S_0$
4	Beryllium	Be	9.320	$2s^2$ $\ ^1S_0$	39	Yttrium	Y	6.6	$4d$ $5s^2$ $\ ^2D_{1\frac12}$
5	Boron	B	8.296	$2s^2$ $2p$ $\ ^2P^o_{1/2}$	40	Zirconium	Zr	6.95	$4d^2$ $5s^2$ $\ ^3F_2$
6	Carbon	C	11.264	$2s^2$ $2p^2$ $\ ^3P_0$	41	Columbium	Cb	6.77	$4d^4$ $5s$ $\ ^6D_{1\frac12}$
7	Nitrogen	N	14.54	$2s^2$ $2p^3$ $\ ^4S^o_{1\frac12}$	42	Molybdenum	Mo	7.18	$4d^5$ $5s$ $\ ^7S_3$
8	Oxygen	O	13.614	$2s^2$ $2p^4$ $\ ^3P_2$	43	Technetium	Tc		$4d^5$ $5s^2$ $\ ^6S_{2\frac12}$
9	Fluorine	F	17.42	$2s^2$ $2p^5$ $\ ^2P^o_{1\frac12}$	44	Ruthenium	Ru	7.5	$4d^7$ $5s$ $\ ^5F_5$
10	Neon	Ne	21.559	$(2s^2\ 2p^6)$ $\ ^1S_0$	45	Rhodium	Rh	7.7	$4d^8$ $5s$ $\ ^4F_{4\frac12}$
11	Sodium	Na	5.138	$3s$ $\ ^2S_{1/2}$	46	Palladium	Pd	8.33	$4d^{10}$ $\ ^1S_0$
12	Magnesium	Mg	7.644	$3s^2$ $\ ^1S_0$	47	Silver	Ag	7.574	$5s$ $\ ^2S_{1/2}$
13	Aluminum	Al	5.984	$3s^2$ $3p$ $\ ^2P^o_{1/2}$	48	Cadmium	Cd	8.991	$5s^2$ $\ ^1S_0$
14	Silicon	Si	8.149	$3s^2$ $3p^2$ $\ ^3P_0$	49	Indium	In	5.785	$5s^2$ $5p$ $\ ^2P^o_{1/2}$
15	Phosphorus	P	11.0	$3s^2$ $3p^3$ $\ ^4S^o_{1\frac12}$	50	Tin	Sn	7.332	$5s^2$ $5p^2$ $\ ^3P_0$
16	Sulfur	S	10.357	$3s^2$ $3p^4$ $\ ^3P_2$	51	Antimony	Sb	8.64	$5s^2$ $5p^3$ $\ ^4S^o_{1\frac12}$
17	Chlorine	Cl	13.01	$3s^2$ $3p^5$ $\ ^2P^o_{1\frac12}$	52	Tellurium	Te	9.01	$5s^2$ $5p^4$ $\ ^3P_2$
18	Argon	A	15.755	$(3s^2\ 3p^6)$ $\ ^1S_0$	53	Iodine	I	10.44	$5s^2$ $5p^5$ $\ ^2P^o_{1\frac12}$
19	Potassium	K	4.339	$4s$ $\ ^2S_{1/2}$	54	Xenon	Xe	12.127	$(5s^2\ 5p^6)$ $\ ^1S_0$
20	Calcium	Ca	6.111	$4s^2$ $\ ^1S_0$	55	Cesium	Cs	3.893	$6s$ $\ ^2S_{1/2}$
21	Scandium	Sc	6.56	$3d$ $4s^2$ $\ ^2D_{1\frac12}$	56	Barium	Ba	5.210	$6s^2$ $\ ^1S_0$
22	Titanium	Ti	6.83	$3d^2$ $4s^2$ $\ ^3F_2$	57	Lanthanum	La	5.61	$5d$ $6s^2$ $\ ^2D_{1\frac12}$
23	Vanadium	V	6.74	$3d^3$ $4s^2$ $\ ^4F_{1\frac12}$	58	Cerium	Ce	(6.91)	
24	Chromium	Cr	6.76	$3d^5$ $4s$ $\ ^7S_3$	59	Praseodymium	Pr	(5.76)	
25	Manganese	Mn	7.432	$3d^5$ $4s^2$ $\ ^6S_{2\frac12}$	60	Neodymium	Nd	(6.31)	$4f^4$ $6s^2$ $\ ^5I_4$
26	Iron	Fe	7.896	$3d^6$ $4s^2$ $\ ^5D_4$	61	Prometheum	Pm		
27	Cobalt	Co	7.86	$3d^7$ $4s^2$ $\ ^4F_{4\frac12}$	62	Samarium	Sm	5.6	$4f^6$ $6s^2$ $\ ^7F_0$
28	Nickel	Ni	7.633	$3d^8$ $4s^2$ $\ ^3F_4$	63	Europium	Eu	5.67	$4f^7$ $6s^2$ $\ ^8S_{3\frac12}$
29	Copper	Cu	7.723	$(3d^{10})$ $4s$ $\ ^2S_{1/2}$	64	Gadolinium	Gd	6.16	$4f^7$ $5d$ $6s^2$ $\ ^9D_2$
30	Zinc	Zn	9.391	$4s^2$ $\ ^1S_0$	65	Terbium	Tb	(6.74)	
31	Gallium	Ga	6.00	$4s^2$ $4p$ $\ ^2P^o_{1/2}$	66	Dysprosium	Dy	(6.82)	
32	Germanium	Ge	8.13	$4s^2$ $4p^2$ $\ ^3P_0$	67	Holmium	Ho		
33	Arsenic	As	10 ±	$4s^2$ $4p^3$ $\ ^4S^o_{1\frac12}$	68	Erbium	Er		
34	Selenium	Se	9.750	$4s^2$ $4p^4$ $\ ^3P_2$	69	Thulium	Tm		$4f^{13}$ $6s^2$ $\ ^2F^o_{3\frac12}$
35	Bromine	Br	11.84	$4s^2$ $4p^5$ $\ ^2P^o_{1\frac12}$	70	Ytterbium	Yb	6.2	$(4f^{14})$ $6s^2$ $\ ^1S_0$

TABLE 23. THE CHEMICAL ELEMENTS—IONIZATION POTENTIALS—Continued

Z	Element	Symbol	I. P.	Ground State			Z	Element	Symbol	I. P.	Ground State		
71	Lutecium	Lu	5. 0	$5d$	$6s^2$	$^2D_{2\frac12}$	88	Radium	Ra	5. 277		$7s^2$	$^1S_0$
72	Hafnium	Hf	5. 5 ±	$5d^2$	$6s^2$	$^3F_2$	89	Actinium	Ac				
73	Tantalum	Ta	6 ±	$5d^3$	$6s^2$	$^4F_{1\frac12}$	90	Thorium	Th		$6d^2$	$7s^2$	$^3F_2$
74	Tungsten	W	7. 98	$5d^4$	$6s^2$	$^5D_0$	91	Protactinium	Pa				
75	Rhenium	Re	7. 87	$5d^5$	$6s^2$	$^6S_{2\frac12}$	92	Uranium	U	4 ±	$5f^3\,6d$	$7s^2$	$^5L_6^\circ$
76	Osmium	Os	8. 7	$5d^6$	$6s^2$	$^5D_4$	93	Neptunium	Np				
77	Iridium	Ir	9. 2	$5d^7$	$6s^2$	$^4F_{1\frac12}$	94	Plutonium	Pu				
78	Platinum	Pt	8. 96	$5d^9$	$6s$	$^3D_3$	95	Americium	Am				
79	Gold	Au	9. 223	$(5d^{10})$	$6s$	$^2S_{\frac12}$	96	Curium	Cm				
80	Mercury	Hg	10. 434		$6s^2$	$^1S_0$	97						
81	Thallium	Tl	6. 106	$6s^2$	$6p$	$^2P_{\frac12}^\circ$	98						
82	Lead	Pb	7. 415	$6s^2$	$6p^2$	$^3P_0$	99						
83	Bismuth	Bi	8 ±	$6s^2$	$6p^3$	$^4S_{1\frac12}^\circ$	100						
84	Polonium	Po					101						
85	Astatine	At					102						
86	Radon	Rn	10. 745	$(6s^2$	$6p^6)$	$^1S_0$	103						
87	Francium	Fa											

* Parentheses denote values that have been determined experimentally, but not yet confirmed by series.

TABLE 24. CHEMICAL SYMBOLS

Symbol	Element	Z	Symbol	Element	Z	Symbol	Element	Z	Symbol	Element	Z
A	Argon	18	Dy	Dysprosium	66	Mn	Manganese	25	S	Sulfur	16
Ac	Actinium	89	Er	Erbium	68	Mo	Molybdenum	42	Sb	Antimony	51
Ag	Silver	47	Eu	Europium	63	N	Nitrogen	7	Sc	Scandium	21
Al	Aluminum	13	F	Fluorine	9	Na	Sodium	11	Se	Selenium	34
Am	Americium	95	Fa	Francium	87	Nd	Neodymium	60	Si	Silicon	14
As	Arsenic	33	Fe	Iron	26	Ne	Neon	10	Sm	Samarium	62
At	Astatine	85	Ga	Gallium	31	Ni	Nickel	28	Sn	Tin	50
Au	Gold	79	Gd	Gadolinium	64	Np	Neptunium	93	Sr	Strontium	38
B	Boron	5	Ge	Germanium	32	O	Oxygen	8	Ta	Tantalum	73
Ba	Barium	56	H	Hydrogen	1	Os	Osmium	76	Tb	Terbium	65
Be	Beryllium	4	(D	Deuterium)		P	Phosphorus	15	Tc	Technetium	43
Bi	Bismuth	83	(T	Tritium)		Pa	Protactinium	91	Te	Tellurium	52
Br	Bromine	35	He	Helium	2	Pb	Lead	82	Th	Thorium	90
C	Carbon	6	Hf	Hafnium	72	Pd	Palladium	46	Ti	Titanium	22
Ca	Calcium	20	Hg	Mercury	80	Pm	Prometheum	61	Tl	Thallium	81
Cb	Columbium	41	Ho	Holmium	67	Po	Polonium	84	Tm	Thulium	69
Cd	Cadmium	48	I	Iodine	53	Pr	Praseodymium	59	U	Uranium	92
Ce	Cerium	58	In	Indium	49	Pt	Platinum	78	V	Vanadium	23
Cl	Chlorine	17	Ir	Iridium	77	Pu	Plutonium	94	W	Tungsten	74
Cm	Curium	96	K	Potassium	19	Ra	Radium	88	Xe	Xenon	54
Co	Cobalt	27	Kr	Krypton	36	Rb	Rubidium	37	Y	Yttrium	39
Cr	Chromium	24	La	Lanthanum	57	Re	Rhenium	75	Yb	Ytterbium	70
Cs	Cesium	55	Li	Lithium	3	Rh	Rhodium	45	Zn	Zinc	30
Cu	Copper	29	Lu	Lutecium	71	Rn	Radon	86	Zr	Zirconium	40
			Mg	Magnesium	12	Ru	Ruthenium	44			

TABLE 25. THE PERIODIC SYSTEM*

Period	Subshell	Elements									
1	1s	H 1	He 2								
2	2s	Li 3	Be 4								
	2p	B 5	C 6	N 7	O 8	F 9	Ne 10				
3	3s	Na 11	Mg 12								
	3p	Al 13	Si 14	P 15	S 16	Cl 17	A 18				
4	{4s	K 19	Ca 20								
	3d	Sc 21	Ti 22	V 23	Cr 24	Mn 25	Fe 26	Co 27	Ni 28	Cu 29	Zn 30
	4p	Ga 31	Ge 32	As 33	Se 34	Br 35	Kr 36				
5	{5s	Rb 37	Sr 38								
	4d	Y 39	Zr 40	Cb 41	Mo 42	Tc 43	Ru 44	Rh 45	Pd 46	Ag 47	Cd 48
	5p	In 49	Sn 50	Sb 51	Te 52	I 53	Xe 54				
6	{6s	Cs 55	Ba 56								
	4f	La 57 — Ce 58 Pr 59 Nd 60 Pm 61 Sm 62 Eu 63 Gd 64 Tb 65 Dy 66 Ho 67 Er 68 Tm 69 Yb 70									
	{5d	Lu 71	Hf 72	Ta 73	W 74	Re 75	Os 76	Ir 77	Pt 78	Au 79	Hg 80
	6p	Tl 81	Pb 82	Bi 83	Po 84	At 85	Rn 86				
7	{7s	Fr 87	Ra 88								
	5f	Ac 89 — Th 90 Pa 91 U 92 Np 93 Pu 94 Am 95 Cm 96 97 98 99 100 101 102									
	{6d	103 -- -- -- -- -- -- -- -- -- --									

*This arrangement is by Catalán. The electrons indicated in column two that are connected by braces have approximately the same binding energy. Consequently, for some elements one type of electron is preferred over another in the normal configuration, as for example, Cr, Cb, Pd, La, Ac, Th.

TABLE 26. INDEX—ISOELECTRONIC SEQUENCES

[The tabular entries are page numbers.]

Z	Element	Spectrum														
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
1	H, D, T	1, 3														
2	He	4	6													
3	Li	8	10	11												
4	Be	12	14	14	15											
5	B	16	17	19	19	20										
6	C	21	24	26	29	30	31									
7	N	32	35	38	40	42	43	44								
8	O	45	47	50	53	56	58	59	59							
9	F	60	62	64	66	69	71	74	75							
10	Ne	76	81	83	84	86	88									
11	Na	89	91	93	95	96	98	100	103	105						
12	Mg	106	108	109	111	113	114	117	119	121	122	123				
13	Al	124	126	129	130	131	133	135	136	138	140	142	143			
14	Si	144	147	148	150	151	152	154	156	157	159	160	162			
15	P	163	164	166	168	169	170	171	173	174	176	177	179	180		
16	S	181	183	185	187	188	189	190	191	193	194		194			
17	Cl	195	197	199	201	202	204	205	206	207	209	210				
18	A	211	216	218	220	222	223	224	224	225	226	226			226	
19	K	227	230	231	233	234	236	237	238	239	239	241				
20	Ca	242	245	247	248	249	251	252	253	254	255	255	257	258		258
21	Sc	259	262	263	264	265	266	267	268	269	270	271	272			
22	Ti	273	279	281	283	284	285	286	287	288	288	289	289	290		
23	V	291	298	301	303	304	304	305	306	306		307	307	308	309	

HYDROGEN

H

1 electron $Z=1$

Ground state $1s\ ^2S_{1/2}$

$1s\ ^2S_{1/2}$ **109678.758** cm^{-1} I. P. 13.595 volts

This table deals only with the light isotope of hydrogen, H^1; cf. page 3 for the other isotopes. The levels through $n=40$ have been calculated by J. E. Mack, "using $R_{H^1}=109677.581$ cm^{-1} and $\alpha^2=5.3256\times10^{-5}$, and taking into account the Lamb-Retherford shift of the s-levels as well as the Sommerfeld-Dirac fine structure, according to the equation

$$\text{Level}_n - \text{Level}_\infty = R_A\left\{-n^{-2}Z^2 + \alpha^2 n^{-3}Z^4\left[-(J+\tfrac{1}{2})^{-1} + 3(4n)^{-1} + \Lambda_{nlZA}\right] + \cdots\right\}.$$

Here A is the atomic weight, and α is the Sommerfeld fine-structure constant. The s-shift parameter Λ is appreciable only for $l=0$, and depends slowly upon n and Z and probably negligibly upon A; it is found from the work of Lamb and Retherford to be 0.0485 ±0.0002 for the $2s$-level of hydrogen, and in the calculation of this table it is assumed to be independent of n.

The intervals are carried one place farther than the level values, insofar as they are accurately known.

The $1s\ ^2S_{1/2}$ level consists of two hyperfine structure components separated by 0.0473824 ±0.0000008 cm^{-1}, the lower of which has $F=0$ and the other $F=1$.

In any one-electron spectrum the correction arising from any modification ΔR of the value accepted for the Rydberg constant may be calculated to a close approximation from the equation

$$\Delta(\text{level}) = (1-n^{-2})Z^2\Delta R.''$$

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Config.	Desig.	J	Level	Interval
1s	1s ^{2}S	½	0. 000	
2p	2p ^{2}P°	½	82258. 907	
2s	2s ^{2}S	½	82258. 942	0.0354
2p	2p ^{2}P°	1½	82259. 272	0. 3651
3p	3p ^{2}P°	½	97492. 198	
3s	3s ^{2}S	½	97492. 208	0. 010
3p, 3d	3d ^{2}D, 3p ^{2}P°	1½	97492. 306	0. 1082
3d	3d ^{2}D	2½	97492. 342	0. 0361
4p	4p ^{2}P°	½	102823. 835	
4s	4s ^{2}S	½	102823. 839	0. 004
4p, 4d	4d ^{2}D, 4p ^{2}P°	1½	102823. 881	0. 0456
4d, 4f	4d ^{2}D, 4f ^{2}F°	2½	102823. 896	0. 0152
4f	4f ^{2}F°	3½	102823. 904	0. 0076
5p	5p ^{2}P°	½	105291. 615	
5s	5s ^{2}S	½	105291. 617	0. 002
5p, 5d	5d ^{2}D, 5p ^{2}P°	1½	105291. 638	0. 0233
5d, 5f	5d, ^{2}D, 5f ^{2}F°	2½	105291. 646	0. 0078
5f, 5g	5g ^{2}G, 5f ^{2}F°	3½	105291. 650	0. 0039
5g	5g ^{2}G	4½	105291. 652	0. 0024
6p	6p ^{2}P°	½	106632. 135	
6s	6s ^{2}S	½	106632. 136	0. 001
6p, 6d	6d ^{2}D, 6p ^{2}P°	1½	106632. 148	0. 0136
6d, 6f	6d ^{2}D, 6f ^{2}F°	2½	106632. 152	0. 0045
6f, 6g	6g ^{2}G, 6f ^{2}F°	3½	106632. 155	0. 0022
6g, 6h	6g ^{2}G, 6h ^{2}H°	4½	106632. 156	0. 0014
6h	6h ^{2}H°	5½	106632. 157	0. 0009
7s, etc.	7s ^{2}S, etc.	½, etc.	107440. 425 to . 439	0. 014
8s, etc.	8s ^{2}S, etc.	½, etc.	.107965. 036 to . 045	0. 009
9s, etc.	9s ^{2}S, etc.	½, etc.	108324. 706 to . 714	0. 008
10s, etc.	10s ^{2}S, etc.	½, etc.	108581. 98	
11s, etc.	11s ^{2}S, etc.	½, etc.	108772. 33	
12s, etc.	12s ^{2}S, etc.	½, etc.	108917. 11	
13s, etc.	13s ^{2}S, etc.	½, etc.	109029. 78	
14s, etc.	14s ^{2}S, etc.	½, etc.	109119. 18	
15s, etc.	15s ^{2}S, etc.	½, etc.	109191. 30	

Config	Desig.	J	Level	Interval
16s, etc.	16s ^{2}S, etc.	½, etc.	109250. 33	
17s, etc.	17s ^{2}S, etc.	½, etc.	109299. 25	
18s, etc.	18s ^{2}S, etc.	½, etc.	109340. 25	
19s, etc.	19s ^{2}S, etc.	½, etc.	109374. 94	
20s, etc.	20s ^{2}S, etc.	½, etc.	109404. 57	
21s, etc.	21s ^{2}S, etc.	½, etc.	109430. 06	
22s, etc.	22s ^{2}S, etc.	½, etc.	109452. 15	
23s, etc.	23s ^{2}S, etc.	½, etc.	109471. 428	
24s, etc.	24s ^{2}S, etc.	½, etc.	109488. 346	
25s, etc.	25s ^{2}S, etc.	½, etc.	109503. 274	
26s, etc.	26s ^{2}S, etc.	½, etc.	109516. 513	
27s, etc.	27s ^{2}S, etc.	½, etc.	109528. 309	
28s, etc.	28s ^{2}S, etc.	½, etc.	109538. 863	
29s, etc.	29s ^{2}S, etc.	½, etc.	109548. 345	
30s, etc.	30s ^{2}S, etc.	½, etc.	109556. 894	
31s, etc.	31s ^{2}S, etc.	½, etc.	109564. 629	
32s, etc.	32s ^{2}S, etc.	½, etc.	109571. 651	
33s, etc.	33s ^{2}S, etc.	½, etc.	109578. 044	
34s, etc.	34s ^{2}S, etc.	½, etc.	109583. 881	
35s, etc.	35s ^{2}S, etc.	½, etc.	109589. 225	
36s, etc.	36s ^{2}S, etc.	½, etc.	109594. 130	
37s, etc.	37s ^{2}S, etc.	½, etc.	109598. 643	
38s, etc.	38s ^{2}S, etc.	½, etc.	109602. 804	
39s, etc.	39s ^{2}S, etc.	½, etc.	109606. 649	
40s, etc.	40s ^{2}S, etc.	½, etc.	109610. 210	
	$\infty = Limit$		109678. 758	

February 1949.

DEUTERIUM and TRITIUM

D and T

1 electron $Z=1$

Ground state $1s\ ^2S_{1/2}$

$1s\ ^2S_{1/2}$ D (H^2) **109708.596** cm^{-1} I. P.   D 13.598 volts

$1s\ ^2S_{1/2}$ T (H^3) **109718.526** cm^{-1} I. P.   T 13.600 volts

The term values have been calculated by J. E. Mack, "using $R_D=109707.419$ and $R_T=109717.348$ cm^{-1}, and taking into account the same fine structure as in hydrogen. Lamb and Retherford have found that the 2s-shift in deuterium is the same as in light hydrogen within about 0.5 percent. Levels not given here may be calculated from the hydrogen table with the aid of the correction equations

$$\text{Level}_D - \text{Level}_H = (1-n^{-2})29.838 \text{ cm}^{-1} \text{ and } \text{Level}_T - \text{Level}_H = (1-n^{-2})39.768 \text{ cm}^{-1}.$$

Nafe and Nelson have kindly communicated the results of their hyperfine structure measurements in tritium in advance of publication. In both isotopes the 1s-level has two hyperfine-structure components, the lower of which has the lower F-value. In deuterium the separation is 0.01092095 ±0.00000023 cm^{-1}, and the F-values are 1/2 and 3/2. In tritium the separation is 0.0505945 ±0.0000010 cm^{-1}, the F-values 0 and 1."

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J. E. Mack, unpublished material (1949).   (I P) (T) (C L)

			D	**T**	
Config.	Desig.	J	Level	Level	Interval
$1s$	$1s\ ^2S$	½	0.000	0.000	
$2p$		½	82281.285	82288.733	
$2s$	$2s\ ^2S$ $2p\ ^2P°$	½	82281.320	82288.768	0.0354
$2p$	$2p\ ^2P°$	1½	82281.650	82289.098	0.3652
$3p$		½	97518.721	97527.547	
$3s$	$3s\ ^2S$ $3p\ ^2P°$	½	97518.731	97527.558	0.010
$3p, 3d$	$3d\ ^2D,\ 3p\ ^2P°$	1½	97518.829	97527.656	0.1082
$3d$	$3d\ ^2D$	2½	97518.865	97527.692	0.0361
$4p$		½	102851.808	102861.118	
$4s$	$4s\ ^2S$ $4p\ ^2P°$	½	102851.812	102861.122	0.004
$4p, 4d$	$4d\ ^2D,\ 4p\ ^2P°$	1½	102851.854	102861.163	0.0456
$4d, 4f$	$4d\ ^2D,\ 4f\ ^2F°$	2½	102851.869	102861.178	0.0152
$4f$	$4f\ ^2F°$	3½	102851.877	102861.186	0.0076
$5p$		½	105320.260	105329.792	
$5s$	$5s\ ^2S$ $5p\ ^2P°$	½	105320.262	105329.795	0.002
$5p, 5d$	$5d\ ^2D,\ 5p\ ^2P°$	1½	105320.283	105329.816	0.0233
$5d, 5f$	$5d\ ^2D,\ 5f\ ^2F°$	2½	105320.291	105329.824	0.0078
$5f, 5g$	$5g\ ^2G,\ 5f\ ^2F°$	3½	105320.294	105329.827	0.0039
$5g$	$5g\ ^2G$	4½	105320.297	105329.830	0.0024
$6p$		½	106661.144	106670.798	
$6s$	$6s\ ^2S$ $6p\ ^2P°$	½	106661.145	106670.800	0.001
$6p, 6d$	$6d\ ^2D,\ 6p\ ^2P°$	1½	106661.158	106670.812	0.0136
$6d, 6f$	$6d\ ^2D,\ 6f\ ^2F°$	2½	106661.162	106670.816	0.0045
$6f, 6g$	$6g\ ^2G,\ 6f\ ^2F°$	3½	106661.164	106670.818	0.0022
$6g, 6h$	$6g\ ^2G,\ 6h\ ^2H°$	4½	106661.166	106670.820	0.0014
$6h$	$6h\ ^2H°$	5½	106661.167	106670.821	0.0009
$7s$, etc.	$7s\ ^2S$, etc.	½, etc.	107469.654 to .669	107479.381 to .396	
$\infty = Limit$			**109708.596**	**109718.526**	

February 1949.

HELIUM

He I

2 electrons $Z=2$

Ground state $1s^2\ {}^1S_0$

$1s^2\ {}^1S_0$ 198305 ± 15 cm^{-1} I. P. 24.580 volts

Most of the terms are taken from Paschen-Götze with the term values subtracted from Paschen's limit as quoted by Robinson in 1937. Higher members of the ${}^1F^\circ$ and ${}^3F^\circ$ series are taken from Meggers and Dieke. The term $2p\ {}^3P^\circ$ has been calculated from its combination with $2s\ {}^3S_1$, using the resolved triplet as observed by Meggers, the intervals being -0.078 cm^{-1} and -0.996 cm^{-1}. The components of $3p\ {}^3P^\circ$ are based on Paschen's value of $3p\ {}^3P_2$ and the intervals observed by Gibbs and Kruger; -0.165 cm^{-1} and -0.192 cm^{-1}.

Some doubt exists regarding the correct classifications of lines attributed to doubly excited helium, such as those observed at 309.04 A and 320.38 A by Compton and Boyce, and at 320.392 A and 357.507 A by Kruger. Approximate theoretical computations of the energies of doubly excited levels have been made by a number of authors and are summarized by Wu. His classification of the line observed at 320.4 A as $2p\ {}^3P^\circ - 2p^2\ {}^3P$ has been adopted and used for the calculation of $2p^2\ {}^3P$.

Several references deal with intercombinations in He I, namely, those by Lyman, Hopfield, Paschen, Suga, and others. The term values based on the excellent long series have been adopted in the table, since it is believed that they are the most accurate.

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He I

Config.	Desig.	J	Level	Config.	Desig.	J	Level
1s²	1s² ¹S	0	0±15	1s 7s	7s ¹S	0	195973. 19
1s 2s	2s ³S	1	159850. 318	1s 7p	7p ³P°	2, 1, 0	196021. 72
1s 2s	2s ¹S	0	166271. 70	1s 7d	7d ³D	3, 2, 1	196064. 00
1s 2p	2p ³P°	2	169081. 111	1s 7d	7d ¹D	2	196064. 31
		1	169081. 189	1s 7f	7f ¹F°	3	196065. 4
		0	169082. 185	1s 7f	7f ³F°	4, 3, 2	196065. 51
1s 2p	2p ¹P°	1	171129. 148	1s 7p	7p ¹P°	1	196073. 41
1s 3s	3s ³S	1	183231. 08	1s 8s	8s ³S	1	196455. 79
1s 3s	3s ¹S	0	184859. 06	1s 8s	8s ¹S	0	196529. 03
1s 3p	3p ³P°	2	185558. 92	1s 8p	8p ³P°	2, 1, 0	196561. 08
		1	185559. 085				
		0	185559. 277	1s 8d	8d ³D	3, 2, 1	196589. 42
1s 3d	3d ³D	3, 2, 1	186095. 90	1s 8d	8d ¹D	2	196589. 73
1s 3d	3d ¹D	2	186099. 22	1s 8f	8f ¹F°	3	196590. 3
1s 3p	3p ¹P°	1	186203. 62	1s 8f	8f ³F°	4, 3, 2	196590. 42
1s 4s	4s ³S	1	190292. 46	1s 8p	8p ¹P°	1	196595. 56
1s 4s	4s ¹S	0	190934. 50	1s 9s	9s ³S	1	196856. 37
1s 4p	4p ³P°	2, 1, 0	191211. 42	1s 9s	9s ¹S	0	196907. 13
1s 4d	4d ³D	3, 2, 1	191438. 83	1s 9p	9p ³P°	2, 1, 0	196929. 68
1s 4d	4d ¹D	2	191440. 71	1s 9d	9d ¹D	2	196949. 49
1s 4f	4f ³F°	4, 3, 2	191446. 61	1s 9d	9d ³D	3, 2, 1	196949. 63
1s 4f	4f ¹F°	3	191447. 24	1s 9f	9f ¹F°	3	196950. 3
1s 4p	4p ¹P°	1	191486. 95	1s 9f	9f ³F°	4, 3, 2	196950. 36
1s 5s	5s ³S	1	193341. 33	1s 9p	9p ¹P°	1	196953. 95
1s 5s	5s ¹S	0	193657. 78	1s 10s	10s ³S	1	197139. 76
1s 5p	5p ³P°	2, 1, 0	193795. 07	1s 10s	10s ¹S	0	197176. 36
1s 5d	5d ³D	3, 2, 1	193911. 48	1s 10p	10p ³P°	2, 1, 0	197192. 63
1s 5d	5d ¹D	2	193912. 54	1s 10d	10d ¹D	2	197207. 08
1s 5f	5f ¹F°	3	193914. 31	1s 10d	10d ³D	3, 2, 1	197207. 30
1s 5f	5f ³F°	4, 3, 2	193915. 79	1s 10f	10f ³F°	4, 3, 2	197208. 0
1s 5p	5p ¹P°	1	193936. 75	1s 10p	10p ¹P°	1	197210. 41
1s 6s	6s ³S	1	194930. 46	1s 11s	11s ³S	1	197347. 05
1s 6s	6s ¹S	0	195109. 17	1s 11p	11p ³P°	2, 1, 0	197386. 98
1s 6p	6p ³P°	2, 1, 0	195187. 21	1s 11d	11d ¹D	2	197397. 62
1s 6d	6d ³D	3, 2, 1	195254. 37	1s 11d	11d ³D	3, 2, 1	197397. 75
1s 6d	6d ¹D	2	195255. 02	1s 11f	11f ³F°	4, 3, 2	197398. 6
1s 6f	6f ¹F°	3	195256. 7	1s 11p	11p ¹P°	1	197400. 18
1s 6f	6f ³F°	4, 3, 2	195256. 82	1s 12s	12s ³S	1	197503. 69
1s 6p	6p ¹P°	1	195269. 17	1s 12s	12s ¹S	0	197524. 26
1s 7s	7s ³S	1	195862. 63				

Config.	Desig.	J	Level	Config.	Desig.	J	Level
1s 12p	12p ³P°	2, 1, 0	*197534. 44*	1s 16d	16d ³D	3, 2, 1	197876. 41
1s 12d	12d ¹D	2	197542. 54	1s 16p	16p ¹P°	1	*197877. 04*
1s 12d	12d ³D	3, 2, 1	197542. 67	1s 17p	17p ³P°	2, 1, 0	*197922. 51*
1s 12p	12p ¹P°	1	*197544. 56*	1s 17d	17d ³D	3, 2, 1	197925. 33
1s 13s	13s ³S	1	197624. 98	1s 17p	17p ¹P°	1	*197925. 87*
1s 13p	13p ³P°	2, 1, 0	*197649. 07*	1s 18p	18p ³P°	2, 1, 0	*197964. 02*
1s 13s	13s ¹S	0	197649. 78	1s 18d	18d ³D	3, 2, 1	197966. 75
1s 13d	13d ¹D	2	197655. 19	1s 18p	18p ¹P°	1	*197966. 80*
1s 13d	13d ³D	3, 2, 1	197655. 47	1s 19p	19p ³P°	2, 1, 0	*197999. 12*
1s 13p	13p ¹P°	1	*197656. 95*	1s 19d	19d ³D	3, 2, 1	198001. 43
1s 14s	14s ³S	1	197721. 13	1s 19p	19p ¹P°	1	*198001. 44*
1s 14p	14p ³P°	2, 1, 0	*197739. 90*	1s 20p	20p ³P°	2, 1, 0	*198029. 07*
1s 14d	14d ¹D	2	197744. 918	1s 20p	20p ¹P°	1	*198031. 02*
1s 14d	14d ³D	3, 2, 1	197744. 94	1s 20d	20d ³D	3, 2, 1	198031. 41
1s 14p	14p ¹P°	1	*197746. 15*	1s 21p	21p ³P°	2, 1, 0	*198054. 83*
1s 15s	15s ³S	1	197796. 63	1s 21d	21d ³D	3, 2, 1	198056. 50
1s 15p	15p ³P°	2, 1, 0	*197813. 11*	1s 22p	22p ³P°	2, 1, 0	*198077. 15*
1s 15d	15d ³D	3, 2, 1	197817. 05	----	----	----	----
1s 15p	15p ¹P°	1	*197818. 12*	He II (²S₁⁄₂)	*Limit*	----	198305
1s 16p	16p ³P°	2, 1, 0	*197872. 95*	2p²	2p² ³P	2, 1, 0	481198

August 1946.

He II

Ground state 1s ²S₁⁄₂

1s ²S₁⁄₂ He³ **438889.040** cm⁻¹   I. P.   He³ 54.400 volts

1s ²S₁⁄₂ He⁴ **438908.670** cm⁻¹   I. P.   He⁴ 54.403 volts

The levels have been calculated by J. E. Mack, "using R_{He^4}=109722.264 and taking into account the fine structure as in hydrogen, but with Λ=0.0402±0.009, from the work of Skinner and Lamb on the 2s-level.   The tentative experimental indication that Λ decreases with increasing n has been neglected.   Assuming R_{He^3}=109717.344, the levels of He³ may be calculated to a close approximation from those of He⁴ by the equation

$$\text{Level}_{He^3\,\text{II}} - \text{Level}_{He^4\,\text{II}} = -(1-n^{-2})19.630 \text{ cm}^{-1}."$$

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			He³ II	He⁴ II	
Config.	Desig.	J	Level	Level	Interval
1s	1s ²S	½	0.000	0.000	
2p	2p ²P°	½	329164.390	329179.102	0.470
2s	2s ²S	½	329164.860	329179.572	5.8434
2p	2p ²P°	1½	329170.135	329184.945	
3p	3p ²P°	½	390123.179	390140.622	0.14
3s	3s ²S	½	390123.318	390140.761	1.7314
3p, 3d	3d ²D, 3p ²P°	1½	390124.910	390142.353	0.5771
3d	3d ²D	2½	390125.487	390142.930	
4p	4p ²P°	½	411458.517	411476.917	0.06
4s	4s ²S	½	411458.576	411476.976	0.7304
4p, 4d	4d ²D, 4p ²P°	1½	411459.248	411477.648	0.2435
4d, 4f	4d ²D, 4f ²F°	2½	411459.491	411477.891	0.1217
4f	4f ²F°	3½	411459.613	411478.013	
5p	5p ²P°	½	421333.629	421352.472	0.03
5s	5s ²S	½	421333.659	421352.502	0.3740
5p, 5d	5d ²D, 5p ²P°	1½	421334.003	421352.846	0.1247
5d, 5f	5d ²D, 5f ²F°	2½	421334.128	421352.971	0.0624
5f, 5g	5g ²G, 5f ²F°	3½	421334.190	421353.033	0.0374
5g	5g ²G,	4½	421334.228	421353.071	
6p	6p ²P°	½	426697.845	426716.928	0.02
6s	6s ²S	½	426697.862	426716.945	0.2164
6p, 6d	6d ²D, 6p ²P°	1½	426698.062	426717.145	0.0721
6d, 6f	6d ²D, 6f ²F°	2½	426698.134	426717.217	0.0361
6f, 6g	6g ²G, 6f ²F°	3½	426698.170	426717.253	0.0216
6g, 6h	6g ²G, 6h ²H°	4½	426698.192	246717.275	0.0144
6h	6h ²H°	5½	426698.206	426717.289	
7s, etc.	7s ²S, etc.	½, etc.	--------------	429951.508 to .741	
8s, etc.	8s ²S, etc.	½, etc.	--------------	432050.863 to1.023	
9s, etc.	9s ²S, etc.	½, etc.	--------------	433490.169 to .283	
10s, etc.	10s ²S, etc.	½, etc.	--------------	434519.693 to .777	
11s, etc.	11s ²S, etc.	½, etc.	--------------	435281.423 to .486	
12s, etc.	12s ²S, etc.	½, etc.	--------------	435860.778 to .828	
13s, etc.	13s ²S, etc.	½, etc.	--------------	436311.653 to .692	
14s, etc.	14s ²S, etc.	½, etc.	--------------	436669.407 to .439	
15s, etc.	15s ²S, etc.	½, etc.	--------------	436957.026 to 8.052	
	∞=*Limit*			438908. 670	

February 1949.

LITHIUM

Li I

3 electrons $Z=3$

Ground state $1s^2\, 2s\; {}^2S_{\frac{1}{2}}$

$2s\; {}^2S_{\frac{1}{2}}$ **43487.19±0.02** cm^{-1} I. P. 5.390 volts

The analysis is from Fowler and Paschen-Götze. Meissner has generously furnished in advance of publication preliminary results of level splittings derived from observed fine structure of selected lines. These data are as follows:

Term	Interval (cm⁻¹)	Line resolved (A)	Term	Line resolved (A)
$2p\,{}^2P°$	0. 3366 ±0. 0005*	6707. 912, . 761	$3s\,{}^2S$	8126. 452, . 231
$3d\,{}^2D$	0. 037 ±0. 001	6103. 649, . 538	$4s\,{}^2S$	4971. 745, . 661
$4d\,{}^2D$	0. 015 ±0. 002	4602. 894, . 826	$5s\,{}^2S$	4273. 127, . 066
$5d\,{}^2D$	0. 010 ±0. 003	4132. 618, . 562†	$6s\,{}^2S$	3985. 538, . 485
$6d\,{}^2D$	0. 005 ±0. 003	3915. 346, . 295		

*Average of 6 determinations.
†Edlén and Lidén derive a mean value of 4132.60±0.02 A and the resulting corrected values quoted for $5d\,{}^2D$ and the limit.

The values in the table for the above terms have been calculated from these wavelengths, except for $5d\,{}^2D$. Jackson and Kuhn state that the multiplet splitting of $2p\;{}^2P°=0.3372±0.0005$ cm.$^{-1}$.

The remaining terms given to two decimals have been calculated from the measures by France. The terms $ns\;{}^2S$, $n=7$ to 11, and $nd\;{}^2D$, $n=7$ to 12, are from Werner. All other term values are from Fowler's Report.

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Li I | **Li I**

Config.	Desig.	J	Level	Config.	Desig.	J	Level
2s	2s ²S	½	0. 00	12d	12d ²D	1½, 2½	42725
2p	2p ²P°	½	14903. 66	13p	13p ²P°	½, 1½	42832. 92
		1½	14904. 00	14p	14p ²P°	½, 1½	42923. 39
3s	3s ²S	½	27206. 12	15p	15p ²P°	½, 1½	42995. 51
3p	3p ²P°	½, 1½	30925. 38	16p	16p ²P°	½, 1½	43055. 34
3d	3d ²D	1½	31283. 08	17p	17p ²P°	½, 1½	43105. 42
		2½	31283. 12	18p	18p ²P°	½, 1½	43146. 96
4s	4s ²S	½	35012. 06	19p	19p ²P°	½, 1½	43181. 84
4p	4p ²P°	½, 1½	36469. 55	20p	20p ²P°	½, 1½	43211. 39
4d	4d ²D	1½	36623. 38	21p	21p ²P°	½, 1½	43237. 16
		2½	36623. 40	22p	22p ²P°	½, 1½	43259. 14
4f	4f ²F°	2½, 3½	36630. 2	23p	23p ²P°	½, 1½	43278. 96
5s	5s ²S	½	38299. 50	24p	24p ²P°	½, 1½	43296. 03
5p	5p ²P°	½, 1½	39015. 56	25p	25p ²P°	½, 1½	43311. 45
5d	5d ²D	1½	39094. 93	26p	26p ²P°	½, 1½	43324. 81
		2½	39094. 94	27p	27p ²P°	½, 1½	43336. 40
6f	5f ²F°	2½, 3½	39104. 5	28p	28p ²P°	½, 1½	43346. 39
6s	6s ²S	½	39987. 64	29p	29p ²P°	½, 1½	43354. 91
6p	6p ²P°	½, 1½	40390. 84	30p	30p ²P°	½, 1½	43363. 71
6d	6d ²D	1½	40437. 31	31p	31p ²P°	½, 1½	43372. 06
		2½	40437. 32	32p	32p ²P°	½, 1½	43378. 31
7s	7s ²S	½	40967. 9	33p	33p ²P°	½, 1½	43384. 9
7p	7p ²P°	½, 1½	41217. 35	34p	34p ²P°	½, 1½	43390. 3
7d	7d ²D	1½, 2½	41246. 5	35p	35p ²P°	½, 1½	43395. 4
10d	10d ²D	1½, 2½	41489	36p	36p ²P°	½, 1½	43400. 5
8s	8s ²S	½	41587. 1	37p	37p ²P°	½, 1½	43404. 7
8p	8p ²P°	½, 1½	41751. 63	38p	38p ²P°	½, 1½	43408. 6
8d	8d ²D	1½, 2½	41771. 3	39p	39p ²P°	½, 1½	43412. 4
9s	9s ²S	½	42003. 3	40p	40p ²P°	½, 1½	43416. 9
9p	9p ²P°	½, 1½	42118. 27	41p	41p ²P°	½, 1½	43420. 9
9d	9d ²D	1½, 2½	42131. 3	42p	42p ²P°	½, 1½	43424. 3
10s	10s ²S	½	42298				
10p	10p ²P°	½, 1½	42379. 16	Li II (¹S₀)	*Limit*	-----------	43487. 19
11s	11s ²S	½	42510				
11p	11p ²P°	½, 1½	42569. 1				
11d	11d ²D	1½, 2½	42578				
12p	12p ²P°	½, 1½	42719. 14				

December 1948.

Li II

(He I sequence; 2 electrons) $Z=3$

Ground state $1s^2\ {}^1S_0$

$1s^2\ {}^1S_0$ **610079**±25 cm⁻¹   I. P. 75.6193±0.0031 volts

Singlet series have been published by both Schüler and Werner, the longer ones by Schüler. In the term list Schüler's rounded off values have been used for the terms $4s$ to $7s\ {}^1S$, $5d$ to $8d\ {}^1D$ and $8f\ {}^1F°$. The limit is from Robinson and the $2p$ to $4p\ {}^1P°$ terms are from Edlén. All the remaining terms are from Werner, who gives also an extrapolated value of $2s\ {}^1S_0$, entered in brackets in the table.

Intersystem combinations have not been observed, but the long series should give a reliable determination of the relative positions of the singlet and triplet terms.

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H. A. Robinson, Phys. Rev. **51**, 14 (1937).   (I P) (T) (C L)

W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946).   (Summary hfs)

Li II   Li II

Author	Config.	Desig.	J	Level	Author	Config.	Desig.	J	Level
$1s^2\ {}^1S$	$1s^2$	$1s^2\ {}^1S$	0	0	4F	$1s\ 4f$	$4f\ {}^1F°$	3	*582645*
$2s$	$1s\ 2s$	$2s\ {}^3S$	1	476046	$1s\ 4p\ {}^1P$	$1s\ 4p$	$4p\ {}^1P°$	1	*582832*
$2s$	$1s\ 2s$	$2s\ {}^1S$	0	[490079]	5s	$1s\ 5s$	$5s\ {}^3S$	1	591184
$2p$	$1s\ 2p$	$2p\ {}^3P°$	2, 1, 0	*494273*	5S	$1s\ 5s$	$5s\ {}^1S$	0	591984
$1s\ 2p\ {}^1P$	$1s\ 2p$	$2p\ {}^1P°$	1	*501816*	5p	$1s\ 5p$	$5p\ {}^3P°$	2, 1, 0	*592141*
$3s$	$1s\ 3s$	$3s\ {}^3S$	1	554761	5d	$1s\ 5d$	$5d\ {}^3D$	3, 2, 1	592505
3S	$1s\ 3s$	$3s\ {}^1S$	0	558779	5D	$1s\ 5d$	$5d\ {}^1D$	2	592508
$3p$	$1s\ 3p$	$3p\ {}^3P°$	2, 1, 0	*559501*	5F	$1s\ 5f$	$5f\ {}^1F°$	3	*592523*
3d	$1s\ 3d$	$3d\ {}^3D$	3, 2, 1	561245	5f	$1s\ 5f$	$5f\ {}^3F°$	4, 3, 2	*592527*
3D	$1s\ 3d$	$3d\ {}^1D$	2	561276	5P	$1s\ 5p$	$5p\ {}^1P°$	1	*592639*
$1s\ 3p\ {}^1P$	$1s\ 3p$	$3p\ {}^1P°$	1	*561749*	6s	$1s\ 6s$	$6s\ {}^3S$	1	597122
$4s$	$1s\ 4s$	$4s\ {}^3S$	1	579982	6S	$1s\ 6s$	$6s\ {}^1S$	0	597574
4S	$1s\ 4s$	$4s\ {}^1S$	0	581590	6p	$1s\ 6p$	$6p\ {}^3P°$	2, 1, 0	*597666*
$4p$	$1s\ 4p$	$4p\ {}^3P°$	2, 1, 0	*581897*	6d	$1s\ 6d$	$6d\ {}^3D$	3, 2, 1	597876
4d	$1s\ 4d$	$4d\ {}^3D$	3, 2, 1	582612	6D	$1s\ 6d$	$6d\ {}^1D$	2	597877
4D	$1s\ 4d$	$4d\ {}^1D$	2	582631	6f	$1s\ 6f$	$6f\ {}^3F°$	4, 3, 2	*597886*
$4f$	$1s\ 4f$	$4f\ {}^3F°$	4, 3, 2	*582644*	6F	$1s\ 6f$	$6f\ {}^1F°$	3	*597886*

Li II—Continued

Author	Config.	Desig.	J	Level	Author	Config.	Desig.	J	Level
7s	1s 7s	7s ³S	1	600641	8D	1s 8d	8d ¹D	2	603214
7S	1s 7s	7s ¹S	0	600925	8f	1s 8f	8f ³F°	4, 3, 2	*603221*
7d	1s 7d	7d ³D	3, 2, 1	601115	8F	1s 8f	8f ¹F°	3	*603221*
7D	1s 7d	7d ¹D	2	601115					
7f	1s 7f	7f ³F°	4, 3, 2	*601121*		Li iii (²S½)	*Limit*		610079
7F	1s 7f	7f ¹F°	3	*601122*					

May 1946.

Li III

(H sequence; 1 electron) $Z=3$

Ground state $1s\ ^2S_{\frac{1}{2}}$

$1s\ ^2S_{\frac{1}{2}}$ Li⁶ iii **987644.9 cm⁻¹**   I. P. Li⁶ iii 122.419 volts

$1s\ ^2S_{\frac{1}{2}}$ Li⁷ iii **987657.8 cm⁻¹**   I. P. Li⁷ iii 122.420 volts

Edlén and Ericson found two lines of the Lyman series, and Gale and Hoag found three more and the first Balmer line. Edlén points out that careful measurement of the Lyman line in orders up to the twelfth showed it definitely to the red of the value calculated from the Dirac theory, with an average discrepancy of about 20 cm⁻¹. This disagreement vanishes when the 1s-shift, calculated at 19 cm⁻¹, is taken into account, according to Mack.

J. E. Mack has calculated the terms listed here, "using $R_{Li^7}=109728.723$ and the same value of Λ as in He ii, which probably makes the listed ionization energy too low by something between 0 and 2 cm⁻¹. Assuming $R_{Li^6}=109727.295$, the levels of Li⁶ may be found from the equation

$$\text{Level}_{Li^6}-\text{level}_{Li^7}=-(1-n^{-2})12.9 \text{ cm}^{-1}.\text{''}$$

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B. Edlén and A. Ericson, Nature **125**, 233 (1930); **127**, 405 (1931); Zeit. Phys. **59**, 656 (1930). (CL)
J. E. Mack, unpublished material (1949). (I P) (T) (C L)

Li III   Li III

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
1s	1s ²S	½	0. 0		5p	5p ²P°	½	948152. 2	0. 2
					5s	5s ²S	½	948152. 4	1. 89
2p	2p ²P°	½	740731. 2	2. 4	5p, 5d	5d ²D, 5p ²P°	1½	948154. 1	0. 64
2s	2s ²S	½	740733. 6	29. 58	5d, 5f	5d ²D, 5f ²F°	2½	948154. 8	0. 31
2p	2p ²P°	1½	740760. 8		5f, 5g	5g ²G, 5f ²F°	3½	948155. 1	0. 19
					5g	5g ²G	4½	948155. 3	
3p	3p ²P°	½	877915. 9	0. 7					
3s	3s ²S	½	877916. 6	8. 77					
3p, 3d	3d ²D, 3p ²P°	1½	877924. 7	2. 92	6s, etc.	6s ²S, etc.	½, etc.	960223. 7	
3d	3d ²D	2½	877927. 6					to 5. 5	
4p	4p ²P°	½	925929. 4	0. 3					
4s	4s ²S	½	925929. 7	3. 70	7s, etc.	7s ²S, etc.	½, etc.	967502. 3	
4p, 4d	4d ²D, 4p ²P°	1½	925933. 1	1. 23				to 3. 5	
4d, 4f	4d ²D, 4f ²F°	2½	925934. 3	0. 62					
4f	4f ²F°	3½	925934. 9		∞=*Limit*			987657. 8	

February 1949.

BERYLLIUM

Be I

4 electrons $\qquad$ $Z=4$

Ground state $1s^2\,2s^2\,{}^1S_0$

$2s^2\,{}^1S_0$ **75192.29** cm^{-1} $\qquad$ I. P. 9.320 volts

All but four of the terms are from the work of Paschen or Paschen and Kruger. According to Paschen no intersystem combinations have been observed. The relative positions of the singlet and triplet terms are, however, excellently determined by long series with a relative uncertainty x not exceeding ± 2 cm^{-1}.

The predicted position of the resonance line, $2s^2\,{}^1S_0-2p\,{}^3P_1^\circ$, is 4548.29 A. Paton and Nusbaum have observed a line at 4553.07 A to which they assign this classification, but their result has not been confirmed.

The term values of higher series members, calculated from the series formula but not substantiated by observation, are in brackets in the table.

Four terms are from Edlén's work: $2p^2\,{}^1D$, $3p\,{}^3P^\circ$, $2p^2\,{}^1S$, and $3p\,{}^3P$.

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W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs)

Be I

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$2s^2$	$2s^2\,{}^1S$	0	0. 00		$2s(^2S)3p$	$3p\,{}^1P^\circ$	1	[60187]	
$2s(^2S)2p$	$2p\,{}^3P^\circ$	0	21979. 43+x	0. 68	$2s(^2S)3d$	$3d\,{}^3D$	1, 2, 3	62054. 8 +x	
		1	21980. 11+x	2. 35	$2s(^2S)3d$	$3d\,{}^1D$	2	64428. 15	
		2	21982. 46+x						
$2s(^2S)2p$	$2p\,{}^1P^\circ$	1	42565. 3		$2s(^2S)4s$	$4s\,{}^3S$	1	64507. 7 +x	
$2s(^2S)3s$	$3s\,{}^3S$	1	52082. 07+x		$2s\,(^2S)\,4s$	$4s\,{}^1S$	0	65245. 4	
$2s(^2S)3s$	$3s\,{}^1S$	0	54677. 2		$2s\,(^2S)\,4p$	$4p\,{}^3P^\circ$	0, 1, 2	[65949] +x	
$2p^2$	$2p^2\,{}^1D$	2	56432. 5		$2s\,(^2S)\,4p$	$4p\,{}^1P^\circ$	1	[67228]	
$2s(^2S)3p$	$3p\,{}^3P^\circ$	0, 1, 2	58791. 6 +x		$2s\,(^2S)\,4d$	$4d\,{}^3D$	1, 2, 3	67943. 6 +x	
$2p^2$	$2p^2\,{}^3P$	0	59694. 61+x	1. 40	$2s\,(^2S)\,4d$	$4d\,{}^1D$	2	68781. 2	
		1	59696. 01+x	2. 03	$2s\,(^2S)\,5s$	$5s\,{}^3S$	1	69009. 3 +x	
		2	59698. 04+x						

Be I—Continued

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
2s (^{2}S) 5s	5s ^{1}S	0	69322. 3		2s (^{2}S) 9d	9d ^{3}D	1, 2, 3	73803. 2 +x	
2s (^{2}S) 5p	5p ^{3}P°	0, 1, 2	[69634. 5] +x		2s (^{2}S) 9d	9d ^{1}D	2	73866. 9	
2s (^{2}S) 5d	5d ^{3}D	1, 2, 3	70606. 7 +x		2s (^{2}S) 10s	10s ^{1}S	0	73930. 4	
2s (^{2}S) 5d	5d ^{1}D	2	71002. 3		2s (^{2}S) 10d	10d ^{3}D	1, 2, 3	74070. 6 +x	
2s (^{2}S) 6s	6s ^{3}S	1	71161. 9 +x		2s (^{2}S) 10d	10d ^{1}D	2	74116. 7	
2s (^{2}S) 6s	6s ^{1}S	0	71320. 7		2s (^{2}S) 11s	11s ^{1}S	0	74163. 4	
2s (^{2}S) 6p	6p ^{3}P°	0, 1, 2	[71482. 9] +x		2s (^{2}S) 11d	11d ^{3}D	1, 2, 3	74268. 6 +x	
2p^2	2p^2 ^{1}S	0	71498. 9		2s (^{2}S) 11d	11d ^{1}D	2	74301. 4	
2s (^{2}S) 6d	6d ^{3}D	1, 2, 3	72030. 6 +x		2s (^{2}S) 12d	12d ^{3}D	1, 2, 3	74416. 3 +x	
2s (^{2}S) 6d	6d ^{1}D	2	72251. 1		2s (^{2}S) 12d	12d ^{1}D	2	74443. 2	
2s (^{2}S) 7s	7s ^{3}S	1	72355. 4 +x		Be II (^{2}S$_{1/2}$)	Limit	---------	75192. 29	
2s (^{2}S) 7s	7s ^{1}S	0	72448. 3		2p (^{2}P°) 3s	3s ^{3}P°	0	85554. 96+x	
2s (^{2}S) 7d	7d ^{3}D	1, 2, 3	72881. 9 +x				1	85557. 01+x	2. 05
2s (^{2}S) 7d	7d ^{1}D	2	73017. 2				2	85560. 93+x	3. 92
2s (^{2}S) 8s	8s ^{3}S	1	73089. 1 +x		2p (^{2}P°) 3p	3p ^{3}P	0		
2s (^{2}S) 8s	8s ^{1}S	0	73146. 7				1		
2s (^{2}S) 8d	8d ^{3}D	1, 2, 3	73429. 6 +x				2	91901. 8 +x	
2s (^{2}S) 8d	8d ^{1}D	2	73519. 7		2p (^{2}P°) 3d	3d ^{3}D°	1	[94189.51]+x	
2s (^{2}S) 9s	9s ^{1}S	0	73608. 5				2	94190. 11+x	0. 60
							3	94191. 26+x	1. 15
					2p (^{2}P°) 3d	3d ^{3}P°	0	95162. 1 +x	
							1	95163. 1 +x	1. 0
							2	95165. 0 +x	1. 9

May 1946.

Be I Observed Terms*

Config. 1s^2+	Observed Terms		
2s^2	2s^2 ^{1}S		
2s(^{2}S)2p	{ 2p ^{3}P° 2p ^{1}P°		
2p^2	{ 2p^2 ^{1}S 2p^2 ^{3}P 2p^2 ^{1}D		
	ns (n ≥ 3)	np (n ≥ 3)	nd (n ≥ 3)
2s(^{2}S)nx	{3– 8s ^{3}S {3–11s ^{1}S	3p ^{3}P°	3–12d ^{3}D 3–12d ^{1}D
2p(^{2}P°)nx	3s ^{3}P°	3p ^{3}P	3d ^{3}P° 3d ^{3}D°

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

Be II

(Li I sequence; 3 electrons) $Z=4$

Ground state $1s^2\, 2s\ {}^2S_{1/2}$

$2s\ {}^2S_{1/2}$ **146881.7** cm^{-1} I. P. 18.206 volts

The analysis has been taken from the paper by Paschen and Kruger.

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W. F. Meggers, J. Opt. Soc. Am. **36,** 431 (1946).   (Summary hfs)

Be II   Be II

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
2s	2s ²S	½	0.0		5f	5f ²F°	2½, 3½	129321.9	
2p	2p ²P°	½	31928.8	6.6	6s	6s ²S	½	133559.1	
		1½	31935.4		6p	6p ²P°	½		
3s	3s ²S	½	88231.2				1½	134485.6	
3p	3p ²P°	½	96496.4	1.8	6d	6d ²D	1½, 2½	134682.0	
		1½	96498.2		6f	6f ²F°	2½, 3½	134688.1	
3d	3d ²D	1½, 2½	98053.2		7s	7s ²S	½	137226.0	
4s	4s ²S	½	115465.2		7p	7p ²P°	½		
4p	4p ²P°	½					1½	137796	
		1½	118760		7d	7d ²D	1½, 2½	137920.0	
4d	4d ²D	1½, 2½	119422.2		7f	7f ²F°	2½, 3½	137923.1	
4f	4f ²F°	2½, 3½	119444.6		8d	8d ²D	1½, 2½	140020.4	
5s	5s ²S	½	127336.1						
5p	5p ²P°	½			Be III (¹S₀)	*Limit*	---------	146881.7	
		1½	128970.2						
5d	5d ²D	1½, 2½	129311.3						

April 1946.

Be III

(He I sequence; 2 electrons) $Z=4$

Ground state $1s^2\ {}^1S_0$

$1s^2\ {}^1S_0$ **1241225** ± 100 cm^{-1} I. P. 153.850 ± 0.012 volts

Both Robinson and Edlén report six lines of the singlet series observed, although the earlier members have also been measured by others.   The range is between 81 A and 100 A. The singlet terms have been taken from Robinson's paper.

The relative absolute values of the triplet and singlet terms have been determined by extrapolation of $3d\ {}^3D$ from He I and Li II, according to Edlén, who has generously furnished his unpublished term values of the triplets.   Apparently no intersystem combinations have been observed in Be III, but the existence of the observed line $1s^2\ {}^1S_0 - 2p\ {}^3P_1^o$ in the related spectra from B IV to Al XII, within the errors of measurement of the predicted positions, indicates that the uncertainty x is small.

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H. A. Robinson, Phys. Rev. **51,** 14 (1937).   (I P) (T) (C L)
B. Edlén, unpublished material (Sept. 1947).   (T)

Be III   **Be III**

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
1s²	1s² ¹S	0	0		1s 4p	4p ¹P°	1	*1179830*	
1s 2s	2s ³S	1	*956496+x*		1s 5p	5p ¹P°	1	*1201894*	
1s 2p	2p ³P°	0			1s 6p	6p ¹P°	1	*1213931*	
		1	*983348+x*	15	1s 7p	7p ¹P°	1	*1221135*	
		2	*983363+x*						
1s 2p	2p ¹P°	1	*997466*						
1s 3p	3p ¹P°	1	*1132323*		Be IV (²S½)	*Limit*		**1241225**	

September 1947.

Be IV

(H sequence; 1 electron) $Z=4$

Ground state 1s $^2S_{\frac{1}{2}}$

1s $^2S_{\frac{1}{2}}$ **1756004 cm⁻¹**   I. P. 217.657 volts

Edlén and Ericson first observed this spectrum. Tyrén has observed three, and Robinson six, members of the principal series.

The terms in the table have been calculated by J. E. Mack, who has used $R_{Be^9}=109730.623$ and $\Lambda=0.040$.

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F. Tyrén, Zeit. Phys. **98,** 771 (1936). (C L)

J. E. Mack, unpublished material (1949). (I P) (T) (C L)

Be IV   **Be IV**

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
1s	1s ²S	½	0		5p	5p ²P°	½	1685766	0.5
					5s	5s ²S	½	1685767	6.0
2p	2p ²P°	½	1316965	7	5p, 5d	5d ²D, 5p ²P°	1½	1685772	2.0
2s	2s ²S	½	1316972	93.5	5d, 5f	5d ²D, 5f ²F°	2½	1685774	1.0
2p	2p ²P°	1½	1317058		5f, 5g	5g ²G, 5f ²F°	3½	1695775	0.6
3p	3p ²P°	½	1560886	2	5g	5g ²G	4½	1685776	
3s	3s ²S	½	1560888	27.6	6s, etc.	6s ²S, etc.	½	1707229 to 234	
3p, 3d	3d ²D, 3p ²P°	1½	1560913	9.2					
3d	3d ²D	2½	1560923		7s, etc.	7s ²S, etc.	½	1720170 to 173	
4p	4p ²P°	½	1646254	1					
4s	4s ²S	½	1646255	11.7		∞=*Limit*		**1756004**	
4p, 4d	4d ²D, 4p ²P°	1½	1646266	3.9					
4d, 4f	4d ²D 4f ²F°	2½	1646270	1.9					
4f	4f ²F°	3½	1646272						

February 1949.

BORON

B I

5 electrons $\qquad$ $Z=5$

Ground state $1s\ ^2 2s^2\ 2p\ ^2\mathrm{P}^{\mathrm{o}}_{1/2}$

$2p\ ^2\mathrm{P}^{\mathrm{o}}_{1/2}\ \mathit{66930}$ cm^{-1} $\qquad$ I. P. 8.296 volts

The spectrum is incompletely observed, but 34 lines have been classified in the interval between 1378 A and 2498 A. The terms for which there is an entry in the column of the table headed "Authors", are from Edlén, but a correction of 90 cm^{-1} has been added to the limit as quoted from Selwyn (66840 cm^{-1}). Whitelaw and Mack have recalculated the limit and derived the value B I $2s^2\ 2p\ ^2\mathrm{P}^{\mathrm{o}}_{1/2}$—B II $2s^2\ ^1\mathrm{S}_0$=66930 cm^{-1}, using the ^{2}D series alone because of extra-configurational perturbations in the ^{2}S series. Selwyn averaged the limits from both the ^{2}S and ^{2}D series.

The remaining terms are from an unpublished manuscript kindly furnished by Clearman, who has extended the doublet series by further observations and confirmed the correction to the limit mentioned above. Clearman has also found two quartet terms. No intersystem combinations have been observed, as indicated by x in the table. Edlén estimates that $2p\,^2\mathrm{P}^{\mathrm{o}}_{1/2}$—$2p^2\,^4\mathrm{P}_{2/2}$=28800 cm^{-1}, by analogy with the observed intersystem combinations in C II and N III. The corresponding value of $2p^2\ ^4\mathrm{P}_{1/2}$ is entered in brackets in the table and has been added to all of Clearman's values of quartet terms.

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B I

Authors	Config.	Desig.	J	Level	Interval
2p ²P₁ ²P₂	2s²(¹S)2p	2p ²P°	½ 1½	0 16	16
	2s 2p²	2p² ⁴P	½ 1½ 2½	[28805]+x 28810+x 28816+x	5 6
2p' ⁴P₃					
3s ²S₁	2s²(¹S)3s	3s ²S	½	40040	
2p' ²D	2s 2p²	2p² ²D	{ 1½ 2½ }	47857	
3d ²D	2s²(¹S)3d	3d ²D	{ 1½ 2½ }	54765	
4s ²S₁	2s²(¹S)4s	4s ²S	½	55009	
4d ²D	2s²(¹S)4d	4d ²D	{ 1½ 2½ }	59989	
5s ²S₁	2s²(¹S)5s	5s ²S	½	60146	
	2s²(¹S)6s	6s ²S	½	62098	

B I

Authors	Config.	Desig.	J	Level	Interval
5d ²D	2s²(¹S)5d	5d ²D	{ 1½ 2½ }	62481	
	2s 2p²	2p² ²S	½	63561	
6d ²D	2s²(¹S)6d	6d ²D	{ 1½ 2½ }	63847	
	2s²(¹S)7s	7s ²S	½	64156	
	2s²(¹S)7d	7d ²D	{ 1½ 2½ }	64664	
	2s²(¹S)8d	8d ²D	{ 1½ 2½ }	65195	
	2s²(¹S)9s	9s ²S	½	65553	
B II (¹S₀)	Limit	------		*66930*	
	2s 2p²	2p² ²P	½ 1½	72535 72547	12
	2p³	2p³ ⁴S°	1½	*97037+x*	

August 1947.

B I Observed Terms*

Config. 1s²+	Observed Terms		
2s²(¹S)2p		2p ²P°	
2s 2p²	{ 2p² ²S	2p² ⁴P 2p³ ²P	2p² ²D
2p³	2p³ ⁴S°		

	ns (n≥3)	nd (n≥3)
2s²(¹S)nx	3–7s, 9s ²S	3–8d ²D

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

B II

(Be I sequence; 4 electrons)   Z=5

Ground state 1s² 2s² ¹S₀

2s² ¹S₀ **202895 cm⁻¹**   I. P. 25.149 volts

The terms are from Edlén, who remarks that the observed series, especially in the singlet system, are too short for the precise determination of the limits. By analogy with Be I, C III, and N IV, he interpolates the value of 2s² ¹S₀—2p ³P°₁ as 37340 cm⁻¹, which places the limit 2s² ¹S₀ at 202895.0 cm⁻¹. The absolute values of the singlet terms as published in Edlén's Monograph have therefore been increased by 249 cm⁻¹. The relative uncertainty x is probably less than this. No intersystem combinations have been observed.

An extrapolated value of 3s ¹S₀ is given in brackets.

B II—Continued

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B II

B II

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
$2s\ ^1S_0$	$2s^2$	$2s^2\ ^1S$	0	0. 0		$4p\ ^3P$	$2s(^2S)4p$	$4p\ ^3P°$	0, 1, 2	$171544.\ 7+x$	
$2p\ ^3P_0$ $^3P_1$ $^3P_2$	$2s(^2S)2p$	$2p\ ^3P°$	0 1 2	$37333.\ 6+x$ $37340.\ 0+x$ $37356.\ 4+x$	6. 4 16. 4	$4d\ ^3D$	$2s(^2S)4d$	$4d\ ^3D$	1, 2, 3	$174072.\ 6+x$	
						$4f\ ^3F$	$2s(^2S)4f$	$4f\ ^3F°$	2, 3, 4	$174902.\ 5+x$	
$2p\ ^1P_1$	$2s(^2S)2p$	$2p\ ^1P°$	1	$73396.\ 7$		$4f\ ^1F_3$	$2s(^2S)4f$	$4f\ ^1F°$	3	$174921.\ 5$	
$2p'\ ^3P_0$ $^3P_1$ $^3P_2$	$2p^2$	$2p^2\ ^3P$	0 1 2	$98910.\ 3+x$ $98918.\ 7+x$ $98932.\ 7+x$	8. 4 14. 0	$4d\ ^1D_2$	$2s(^2S)4d$	$4d\ ^1D$	2	$175546.\ 0$	
						$5s\ ^3S_1$	$2s(^2S)5s$	$5s\ ^3S$	1	$180896.\ 5+x$	
$2p'\ ^1D_2$	$2p^2$	$2p^2\ ^1D$	2	$102362.\ 1$		$3s'\ ^3P_0$ $^3P_1$ $^3P_2$	$2p(^2P°)3s$	$3s\ ^3P°$	0 1 2	$181645.\ 2+x$ $181655.\ 0+x$ $181675.\ 9+x$	9. 8 20. 9
$2p'\ ^1S_0$	$2p^2$	$2p^2\ ^1S$	0	$127662.\ 0$							
$3s\ ^3S_1$	$2s(^2S)3s$	$3s\ ^3S$	1	$129772.\ 9+x$		$5d\ ^3D$	$2s(^2S)5d$	$5d\ ^3D$	1, 2, 3	$184633.\ 1+x$	
$3s\ ^1S_0$	$2s(^2S)3s$	$3s\ ^1S$	0	[135946]		$5f\ ^3F$	$2s(^2S)5f$	$5f\ ^3F°$	2, 3, 4	$184908.\ 2+x$	
$3p\ ^3P_{01}$ $^3P_2$	$2s(^2S)3p$	$3p\ ^3P°$	0, 1 2	$143989.\ 7+x$ $143993.\ 4+x$	3. 7	$3p'\ ^1P_1$	$2p(^2P°)3p$	$3p\ ^1P$	1	$189126.\ 6$	
						$3d'\ ^3F_{23}$ $^3F_4$	$2p(^2P°)3d$	$3d\ ^3F°$	2, 3 4	$194748?\ +x$ $194760?\ +x$	12
$3p\ ^1P_1$	$2s(^2S)3p$	$3p\ ^1P°$	1	$144102.\ 0$		$3d'\ ^1D_2$	$2p(^2P°)3d$	$3d\ ^1D°$	2	$197721.\ 0$	
$3d\ ^3D$	$2s(^2S)3d$	$3d\ ^3D$	1, 2, 3	$150649.\ 0+x$		$3d'\ ^3D$	$2p(^2P°)3d$	$3d\ ^3D°$	1, 2, 3	$200484.\ 6+x$	
$3d\ ^1D_2$	$2s(^2S)3d$	$3d\ ^1D$	2	$154686.\ 9$							
$4s\ ^3S_1$	$2s(^2S)4s$	$4s\ ^3S$	1	$166344.\ 4+x$							
$4s\ ^1S_0$	$2s(^2S)4s$	$4s\ ^1S$	0	$167934.\ 2$		B III $(^2S_{1/2})$		**Limit**	------	202895	

May 1946.

B II Observed Terms*

Config. $1s^2+$	Observed Terms			
$2s^2$	$2s^2\ ^1S$			
$2s(^2S)2p$	$\{$ $2p\ ^3P°$ $2p\ ^1P°$			
$2p^2$	$\{$ $2p^2\ ^1S$ $2p^2\ ^3P$ $2p^2\ ^1D$			
	$ns\ (n\geq3)$	$np\ (n\geq3)$	$nd\ (n\geq3)$	$nf\ (n\geq4)$
$2s(^2S)nx$	$\{$ $3-5s\ ^3S$ $4s\ ^1S$	$3, 4p\ ^3P°$ $3p\ ^1P°$	$3-5d\ ^3D$ $3, 4d\ ^1D$	$4, 5f\ ^3F°$ $4f\ ^1F°$
$2p(^2P°)nx$	$\{$ $3s\ ^3P°$	$3p\ ^1P$	$3d\ ^3D°$ $3d\ ^3F°$ $3d\ ^1D°$	

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

B III

(Li I sequence; 3 electrons) $\qquad\qquad$ $Z=5$

Ground state $1s^2\,2s\ ^2S_{\frac{1}{2}}$

$2s\ ^2S_{\frac{1}{2}}$ **305931.1** cm⁻¹ $\qquad\qquad$ I. P. 37.920 volts

The terms are from Edlén. The absolute values are based on the assumption that n^* for $5g\ ^2G$ equals that of the corresponding term in C IV, where $5g\ ^2G - 6h\ ^2H°$ has been observed. The precision of this term in B III is estimated to be within ± 1 cm⁻¹. The series are well represented by a Ritz formula.

Edlén gives four extrapolated term intervals, which are entered in brackets in the table.

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B III $\qquad\qquad$ **B III**

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
$2s\ ^2S_1$	$2s$	$2s\ ^2S$	½	0.0							
$2p\ ^2P_1$ $^2P_2$	$2p$	$2p\ ^2P°$	½ 1½	48358.5 48392.6	34.1	$5p\ ^2P_2$	$5p$	$5p\ ^2P°$	½ 1½	265719.7	[2.2]
$3s\ ^2S_1$	$3s$	$3s\ ^2S$	½	180201.8		$5d\ ^2D_3$	$5d$	$5d\ ^2D$	1½ 2½	266389.5	
$3p\ ^2P_1$ $^2P_2$	$3p$	$3p\ ^2P°$	½ 1½	192949.2 192959.4	10.2	$5f\ ^2F$	$5f$	$5f\ ^2F°$	{ 2½ 3½ }	266416.5	
$3d\ ^2D_3$	$3d$	$3d\ ^2D$	1½ 2½	196071.2	[3.4]	$5g\ ^2G$	$5g$	$5g\ ^2G$	{ 3½ 4½ }	266427.2	
$4s\ ^2S_1$	$4s$	$4s\ ^2S$	½	237695.5		$6d\ ^2D_3$	$6d$	$6d\ ^2D$	1½ 2½	278473.7	
$4p\ ^2P_2$	$4p$	$4p\ ^2P°$	½ 1½	242832.4	[4.3]	$6f\ ^2F$	$6f$	$6f\ ^2F°$	{ 2½ 3½ }	278491.7	
$4d\ ^2D_3$	$4d$	$4d\ ^2D$	1½ 2½	244138.9	[1.4]	$6g\ ^2G$	$6g$	$6g\ ^2G$	{ 3½ 4½ }	278497.5	
$4f\ ^2F$	$4f$	$4f\ ^2F°$	{ 2½ 3½ }	244199.2							
$5s\ ^2S_1$	$5s$	$5s\ ^2S$	½	263156.2		B IV ($^1S_0$)	Limit	------		305931.1	

April 1946.

B IV

(He I sequence; 2 electrons) $\qquad\qquad$ $Z=5$

Ground state $1s^2\ ^1S_0$

$1s^2\ ^1S_0$ **2091960**$\pm$**200** cm⁻¹ $\qquad\qquad$ I. P. 259.298$\pm$0.025 volts

The singlet terms are from Tyrén and the observed singlet combinations are in the range from 48 to 60 A. The unit adopted by Tyrén, 10^3 cm⁻¹, has here been changed to cm⁻¹.

Relative absolute values of the triplet terms were derived by the extrapolation of $3d\ ^3D$ from He I and Li II, according to unpublished material generously furnished by Dr. Edlén. These calculations have confirmed the classification by Tyrén of a line at 61 A as the intersystem combination $1s^2\ ^1S_0 - 2p\ ^3P_1°$. The triplet terms have been taken from Edlén's 1947 manuscript.

B IV—Continued

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F. Tyrén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **12,** No. 1, 24 (1940). (I P) (T) (C L)
B. Edlén, unpublished material (Sept. 1947). (T)

B IV

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$1s^2$	$1s^2\ ^1S$	0	0		$1s\ 4p$	$4p\ ^1P°$	1	*1982750*	
$1s\ 2s$	$2s\ ^3S$	1	1601505		$1s\ 5p$	$5p\ ^1P°$	1	*2022000*	
$1s\ 2p$	$2p\ ^3P°$	0	*1636898*		$1s\ 6p$	$6p\ ^1P°$	1	*2043360*	
		1	*1636882*	−16					
		2	*1636934*	52	B v ($^2S_{1/2}$)	*Limit*	--------	2091960	
$1s\ 2p$	$2p\ ^1P°$	1	*1658020*						
$1s\ 3p$	$3p\ ^1P°$	1	*1898180*						

September 1947.

B V

(H sequence; 1 electron) $Z=5$

Ground state $1s\ ^2S_{1/2}$

$1s\ ^2S_{1/2}$ **2744063 cm⁻¹**   I. P. 340.127 volts

Edlén first observed the Lyman line. Tyrén has observed three members of the series. The listed term values have been calculated by J. E. Mack for B¹¹ v, "using $R_B{}^{11}=109731.835$ and $\Lambda=0.040$; a change of 1 percent in Λ would change the series limit by 1.46 cm⁻¹. For B¹⁰ the series limit is less by 13.6 cm⁻¹ than for B¹¹."

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B V

Config.	Desig.		J	Level	Interval	Config.	Desig.		J	Level	Interval
$1s$	$1s\ ^2S$		½	0		$4p$		$4p\ ^2P°$	½	2572561	2
						$4s$	$4s\ ^2S$		½	2572563	28. 5
$2p$		$2p\ ^2P°$	½	2057954	18	$4p, 4d$	$4d\ ^2D,$	$4p\ ^2P°$	1½	2572589	9. 5
$2s$	$2s\ ^2S$		½	2057972	228. 3	$4d, 4f$	$4d\ ^2D,$	$4f\ ^2F°$	2½	2572599	4. 8
$2p$		$2p\ ^2P°$	1½	2058182		$4f$		$4f\ ^2F°$	3½	2572603	
$3p$		$3p\ ^2P°$	½	2439151	5	$5s$	$5s\ ^2S,$ etc.		½, etc,	2634306	
$3s$	$3s\ ^2S$		½	2439156	67. 6					to 330	
$3p, 3d$	$3d\ ^2D,$	$3p\ ^2P°$	1½	2439218	22. 6						
$3d$	$3d\ ^2D$		2½	2439241							
							$\infty=Limit$		--------	2744063	

February 1949.

CARBON

C I

6 electrons $\qquad\qquad Z=6$

Ground state $1s^2\,2s^2\,2p^2\,{}^3P_0$

$2p^2\,{}^3P_0$ **90878.3** cm^{-1} $\qquad\qquad$ I. P. 11.264 volts

The term assignments are taken from Edlén, who has revised and extended the earlier work on the analysis of this spectrum. Two extrapolated term values, derived from the irregular doublet law, are entered in brackets in the table.

The singlet and triplet terms are well connected by intersystem combinations. Only two quintet terms are known. They are connected with the rest by intersystem combinations based on the measures of the resonance lines by Shenstone.

One term, $5p\,{}^1S$, has been revised as suggested in the 1939 reference listed below.

Selected term values of C I have been improved from a study of the lines that have been clearly identified in the Infrared Solar Spectrum. Such precision cannot be expected from terms based on lines in the ultraviolet. As a starting point the value of $3s\,{}^3P_1^\circ=60353.00$ cm^{-1} was adopted as correct, to agree with Shenstone's recent measures. Excellent agreement was found between the laboratory measures of Kiess (8335 A to 11330 A) and solar wave-numbers of lines identified as C I in the solar spectrum. Further to the red solar wavelengths surpass laboratory values in accuracy and give consistent internal separations within the multiplets.

In the course of this work all term values have been recalculated. Consequently, most of the listed values differ slightly from those published by Edlén. No changes have been made in his analysis, but the level $3d\,{}^3P_0^\circ$, calculated from solar wave-numbers, has been added to his list.

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C I

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^3P_0$	$2s^2\,2p^2$	$2p^2\ ^3P$	0	0.0	
$^3P_1$			1	16.4	16.4
$^3P_2$			2	43.5	27.1
$2p\ ^1D_2$	$2s^2\,2p^2$	$2p^2\ ^1D$	2	10193.70	
$2p\ ^1S_0$	$2s^2\,2p^2$	$2p^2\ ^1S$	0	21648.4	
	$2s\,2p^3$	$2p^3\ ^5S^\circ$	2	33735.2	
$3s\ ^3P_0$	$2s^2\,2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0	60333.80	
$^3P_1$			1	60353.00	19.20
$^3P_2$			2	60393.52	40.52
$3s\ ^1P_1$	$2s^2\,2p(^2P^\circ)3s$	$3s\ ^1P^\circ$	1	61982.20	
$2p'\ ^3D_3$	$2s\,2p^3$	$2p^3\ ^3D^\circ$	3	64088.56	
$^3D_2$			2	64093.19	-4.63
$^3D_1$			1	64092.01	1.18
$3p\ ^1P_1$	$2s^2\,2p(^2P^\circ)3p$	$3p\ ^1P$	1	68858	
$3p\ ^3D_1$	$2s^2\,2p(^2P^\circ)3p$	$3p\ ^3D$	1	69689.79	
$^3D_2$			2	69710.99	21.20
$^3D_3$			3	69744.40	33.41
$3p\ ^3S_1$	$2s^2\,2p(^2P^\circ)3p$	$3p\ ^3S$	1	70744.26	
$3p\ ^3P_0$	$2s^2\,2p(^2P^\circ)3p$	$3p\ ^3P$	0	71352.81	
$^3P_1$			1	71365.23	12.42
$^3P_2$			2	71385.70	20.47
$3p\ ^1D_2$	$2s^2\,2p(^2P^\circ)3p$	$3p\ ^1D$	2	72611.06	
$3p\ ^1S_0$	$2s^2\,2p(^2P^\circ)3p$	$3p\ ^1S$	0	73976.23	
$2p'\ ^3P$	$2s\,2p^3$	$2p^3\ ^3P^\circ$	2, 1, 0	75256.3	
$3d\ ^1D_2$	$2s^2\,2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	77680.5	
$4s\ ^3P_0$	$2s^2\,2p(^2P^\circ)4s$	$4s\ ^3P^\circ$	0	78105.23	
$^3P_1$			1	78117.06	11.83
$^3P_2$			2	78148.36	31.30
$3d\ ^3F_2$	$2s^2\,2p(^2P^\circ)3d$	$3d\ ^3F^\circ$	2	78199.34	
$^3F_3$			3	78215.82	16.48
$^3F_4$			4	78250.22	34.40
$3d\ ^3D_1$	$2s^2\,2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	78300.8	
$^3D_2$			2	78307	6
$^3D_3$			3	78316	9
$4s\ ^1P_1$	$2s^2\,2p(^2P^\circ)4s$	$4s\ ^1P^\circ$	1	78338	
$3d\ ^1F_3$	$2s^2\,2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	78531	
$3d\ ^1P_1$	$2s^2\,2p(^2P^\circ)3d$	$3d\ ^1P^\circ$	1	78727.91	
$3d\ ^3P_2$	$2s^2\,2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	79311.10	
$^3P_1$			1	79319.06	-7.96
			0	79323.32	-4.26
$4p\ ^3D_1$	$2s^2\,2p(^2P^\circ)4p$	$4p\ ^3D$	1	80173.29	
$^3D_2$			2	80192.49	19.20
$^3D_3$			3	80222.74	30.25
$4p\ ^1P_1$	$2s^2\,2p(^2P^\circ)4p$	$4p\ ^1P$	1	80563.57	
$4p\ ^3S_1$	$2s^2\,2p(^2P^\circ)4p$	$4p\ ^3S$	1	81105.70	
$4p\ ^3P_0$	$2s^2\,2p(^2P^\circ)4p$	$4p\ ^3P$	0	81311.52	
$^3P_1$			1	81326.33	14.81
$^3P_2$			2	81344.48	18.15
$4p\ ^1D_2$	$2s^2\,2p(^2P^\circ)4p$	$4p\ ^1D$	2	81770.36	
$4p\ ^1S_0$	$2s^2\,2p(^2P^\circ)4p$	$4p\ ^1S$	0	82252.31	

C I

Edlén	Config.	Desig.	J	Level	Interval
$4d\ ^1D_2$	$2s^2\,2p(^2P^\circ)4d$	$4d\ ^1D^\circ$	2	83500	
	$2s^2\,2p(^2P^\circ)4d$	$4d\ ^3F^\circ$	2		
$4d\ ^3F_3$			3	83761	
			4		
$4d\ ^3D_1$	$2s^2\,2p(^2P^\circ)4d$	$4d\ ^3D^\circ$	1	83830	
$^3D_2$			2	83837	7
$^3D_3$			3	83847	10
$5s\ ^1P_1$	$2s^2\,2p(^2P^\circ)5s$	$5s\ ^1P^\circ$	1	83882.5	
$4d\ ^1F_3$	$2s^2\,2p(^2P^\circ)4d$	$4d\ ^1F^\circ$	3	83949	
$4d\ ^1P_1$	$2s^2\,2p(^2P^\circ)4d$	$4d\ ^1P^\circ$	1	84032	
$4d\ ^3P_2$	$2s^2\,2p(^2P^\circ)4d$	$4d\ ^3P^\circ$	2	84102.6	
$^3P_1$			1	84112	-9
$^3P_0$			0		
$5p\ ^1P_1$	$2s^2\,2p(^2P^\circ)5p$	$5p\ ^1P$	1	84852.13	
	$2s^2\,2p(^2P^\circ)5p$	$5p\ ^3D$	1		
$5p\ ^3D_2$			2	84952	34
$^3D_3$			3	84986.2	
$5p\ ^1D_2$	$2s^2\,2p(^2P^\circ)5p$	$5p\ ^1D$	2	85400.38	
$5p\ ^1S_0$	$2s^2\,2p(^2P^\circ)5p$	$5p\ ^1S$	0	85625.84	
$5d\ ^1D_2$	$2s^2\,2p(^2P^\circ)5d$	$5d\ ^1D^\circ$	2	86187	
$5d\ ^3F_2$	$2s^2\,2p(^2P^\circ)5d$	$5d\ ^3F^\circ$	2	86319	
$^3F_3$			3	86326.9	8
			4		
	$2s^2\,2p(^2P^\circ)5d$	$5d\ ^3D^\circ$	1		
$5d\ ^3D_2$			2	86371.3	25
$^3D_3$			3	86396	
$6s\ ^1P_1$	$2s^2\,2p(^2P^\circ)6s$	$6s\ ^1P^\circ$	1	86413.96	
$5d\ ^1F_3$	$2s^2\,2p(^2P^\circ)5d$	$5d\ ^1F^\circ$	3	86450	
$5d\ ^1P_1$	$2s^2\,2p(^2P^\circ)5d$	$5d\ ^1P^\circ$	1	86491	
$5d\ ^3P_2$	$2s^2\,2p(^2P^\circ)5d$	$5d\ ^3P^\circ$	2	86504	
$^3P_1$			1	86517	-13
			0		
$6d\ ^1D_2$	$2s^2\,2p(^2P^\circ)6d$	$6d\ ^1D^\circ$	2	87632	
$6d\ ^3F_2$	$2s^2\,2p(^2P^\circ)6d$	$6d\ ^3F^\circ$	2	87706	
$^3F_3$			3	87713	7
			4		
	$2s^2\,2p(^2P^\circ)6d$	$6d\ ^3D^\circ$	1		
$6d\ ^3D_2$			2	87752	21
$^3D_3$			3	87773	
$7s\ ^1P_1$	$2s^2\,2p(^2P^\circ)7s$	$7s\ ^1P^\circ$	1	87795.3	
$6d\ ^1F_3$	$2s^2\,2p(^2P^\circ)6d$	$6d\ ^1F^\circ$	3	87807	
$6d\ ^3P_2$	$2s^2\,2p(^2P^\circ)6d$	$6d\ ^3P^\circ$	2	87830	
$^3P_1$			1	87839	-9
			0		
$6d\ ^1P_1$	$2s^2\,2p(^2P^\circ)6d$	$6d\ ^1P^\circ$	1	87831.3	
$7d\ ^3F_2$	$2s^2\,2p(^2P^\circ)7d$	$7d\ ^3F^\circ$	2	88541.8	
$^3F_3$			3	88547	5
$^3F_4$			4		
	$2s^2\,2p(^2P^\circ)7d$	$7d\ ^3D^\circ$	1		
			2		
$7d\ ^3D_3$			3	88607	

C I—Continued   C I—Continued

Edlén	Config.	Desig.	J	Level	Interval
7d ¹F₃	2s² 2p(²P°)7d	7d ¹F°	3	88624	
7d ¹P₁	2s² 2p(²P°)7d	7d ¹P°	1	88632.44	
7d ³P₂	2s² 2p(²P°)7d	7d ³P°	2	88639	
			1		
			0		
8d ³F₃	2s² 2p(²P°)8d	8d ³F°	4		
³F₂			3	89081	−1
			2	89082	
	2s² 2p(²P°)8d	8d ³D°	1		
			2		
8d ³D₃			3	89146	
8d ¹F₃	2s² 2p(²P°)8d	8d ¹F°	3	89155	
8d ³P₂	2s² 2p(²P°)8d	8d ³P°	2	89158	
			1		
			0		
	2s² 2p(²P°)9d	9d ³F°	4		
			3		
9d ³F₂			2	89450	

Edlén	Config.	Desig.	J	Level	Interval
	2s² 2p(²P°)9d	9d ³D°	1		
			2		
9d ³D₃			3	89514	
9d ¹F₃	2s² 2p(²P°)9d	9d ¹F°	3	89517	
	2s² 2p(²P°)10d	10d ³D°	1		
			2		
10d ³D₃			3	89779	
	2s² 2p(²P°)11d	11d ³D°	1		
			2		
11d ³D₃			3	89968.4	
	C II (²P°_{½})	*Limit*	------	90878.3	
2p′ ¹D₂	2s 2p³	2p³ ¹D°	2	[97878]	
	2s 2p²(⁴P)3s	3s ⁵P	1	103541.8	20.7
			2	103562.5	24.8
			3	103587.3	
2p′ ³S₁	2s 2p³	2p³ ³S°	1	105800.5	
2p′ ¹P₁	2s 2p³	2p³ ¹P°	1	[119878]	

September 1947.

C I Observed Terms*

Config. 1s²+	Observed Terms		
2s² 2p²	{ 2p² ¹S 2p² ³P 2p² ¹D		
2s 2p³	{ 2p³ ⁵S° 2p³ ³S° 2p³ ³P° 2p³ ³D° 2p³ ¹P° (2p³ ¹D°)		

	ns (n≥3)	np (n≥3)	nd (n≥3)
2s² 2p(²P°)nx	{ 3, 4s ³P° 3–7s ¹P°	3, 4p ³S 3, 4p ³P 3–5p ³D 3–5p ¹S 3–5p ¹P 3–5p ¹D	3–8d ³P° 3–11d ³D° 3–9d ³F° 3–7d ¹P° 3–6d ¹D° 3–9d ¹F°
2s 2p²(⁴P)nx	3s ⁵P		

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

C II

(B I sequence; 5 electrons) $Z=6$

Ground state $1s^2\,2s^2\,2p\ {}^2P^\circ_{\frac12}$

$2p\ {}^2P^\circ_{\frac12}$ *196659.0* cm^{-1} I. P. 24.376 volts

The term values for the doublets are taken from Edlén's Monograph. He has since rejected his $5p'\ {}^2D$ term. Intersystem combinations have been observed by Edlén (1936) and the resulting correction to the quartet terms as published in his Monograph, $+19.3$ cm^{-1}, has been applied.

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C II

Edlén	Config.	Desig.	J	Level	Interval
2p ²P₁ ²P₂	2s²(¹S)2p	2p ²P°	½ 1½	0.0 64.0	64.0
2p' ⁴P₁ ⁴P₂ ⁴P₃	2s 2p²	2p² ⁴P	½ 1½ 2½	43000.2 43021.8 43050.7	21.6 28.9
2p' ²D₃ ²D₂	2s 2p²	2p² ²D	2½ 1½	74930.9 74933.2	−2.3
2p' ²S₁	2s 2p²	2p² ²S	½	96494.1	
2p' ²P₁ ²P₂	2s 2p²	2p² ²P	½ 1½	110625.1 110666.3	41.2
3s ²S₁	2s²(¹S)3s	3s ²S	½	116537.88	
3p ²P₁ ²P₂	2s²(¹S)3p	3p ²P°	½ 1½	*131724.68* *131735.81*	11.13
2p'' ⁴S₂	2p³	2p³ ⁴S°	1½	*142024.4*	
3d ²D₂ ²D₃	2s² (¹S)3d	3d ²D	1½ 2½	145549.99 145551.44	1.45
2p'' ²D₃ ²D₂	2p³	2p³ ²D°	2½ 1½	*150462.8* *150467.9*	−5.1
4s ²S₁	2s²(¹S)4s	4s ²S	½	157234.43	
4p ²P₁ ²P₂	2s²(¹S)4p	4p ²P°	½ 1½	*162518.70* *162524.62*	5.92
3s' ⁴P₁ ⁴P₂ ⁴P₃	2s 2p(³P°)3s	3s ⁴P°	½ 1½ 2½	*166964.70* *166988.46* *167033.43*	23.76 44.97
4d ²D₂ ²D₃	2s²(¹S)4d	4d ²D	1½ 2½	168123.92 168124.33	0.41
2p'' ²P₁ ²P₂	2p³	2p³ ²P°	½ 1½	*168731.6* *168750.2*	18.6
4f ²F	2s²(¹S)4f	4f ²F°	{ 2½ 3½ }	*168979.05*	

C II

Edlén	Config.	Desig.	J	Level	Interval
5s ²S₁	2s²(¹S)5s	5s ²S	½	173348.18	
5p ²P₁ ²P₂	2s²(¹S)5p	5p ²P°	½ 1½	*175287.9* *175295.2*	7.3
3s' ²P₁ ²P₂	2s 2p(³P°)3s	3s ²P°	½ 1½	*178194.1* *178220.8*	26.7
5d ²D₃	2s²(¹S)5d	5d ²D	1½ 2½	178494.8	
5f ²F	2s²(¹S)5f	5f ²F°	{ 2½ 3½ }	*178956.46*	
6s ²S₁	2s²(¹S)6s	6s ²S	½	181258	
3p' ⁴D₁ ⁴D₂ ⁴D₃ ⁴D₄	2s 2p(³P°)3p	3p ⁴D	½ 1½ 2½ 3½	181694.50 181709.20 181734.21 181770.48	14.70 25.01 36.27
3p' ²P₁ ²P₂	2s 2p(³P°)3p	3p ²P	½ 1½	182025.0 182044.5	19.5
6d ²D₂	2s²(¹S)6d	6d ²D	1½ 2½	184064.9	
6f ²F	2s²(¹S)6f	6f ²F°	{ 2½ 3½ }	*184376.20*	
3p' ⁴S₂	2s 2p(³P°)3p	3p ⁴S	1½	184688.69	
3p' ⁴P₁ ⁴P₂ ⁴P₃	2s 2p(³P°)3p	3p ⁴P	½ 1½ 2½	186425.02 186441.32 186463.75	16.30 22.43
3p' ²D₂ ²D₃	2s 2p(³P°)3p	3p ²D	1½ 2½	188579.3 188612.7	33.4
3p' ²S₁	2s 2p(³P°)3p	3p ²S	½	194571.9	
3d' ⁴F₂ ⁴F₃ ⁴F₄ ⁴F₅	2s 2p(³P°)3d	3d ⁴F°	1½ 2½ 3½ 4½	*195750.8* *195765.1* *195784.7* *195812.3*	14.3 19.6 27.6

C II—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3d'\ ^4D_1$	$2s\,2p(^3P^\circ)3d$	$3d\ ^4D^\circ$	½	196556.2	
$^4D_2$			1½	196561.8	5.6
$^4D_3$			2½	196570.5	8.7
$^4D_4$			3½	196580.8	10.3
	C III ($^1S_0$)	*Limit*	------	**196659.0**	
$3d'\ ^2D_2$	$2s\,2p(^3P^\circ)3d$	$3d\ ^2D^\circ$	1½	198426.4	
$^3D_3$			2½	198437.2	10.8
$3d'\ ^4P_3$	$2s\,2p(^3P^\circ)3d$	$3d\ ^4P^\circ$	2½	198842.0	
$^4P_2$			1½	198863.5	−21.5
$^4P_1$			½	198877.7	−14.2
$3d'\ ^2F_3$	$2s\,2p(^3P^\circ)3d$	$3d\ ^2F^\circ$	2½	199941.4	
$^2F_4$			3½	199984.2	42.8
$3d'\ ^2P_2$	$2s\,2p(^3P^\circ)3d$	$3d\ ^2P^\circ$	1½	202180.3	
$^2P_1$			½	202204.4	−24.1
$4s'\ ^4P_1$	$2s\,2p(^3P^\circ)4s$	$4s\ ^4P^\circ$	½	209550.26	
$^4P_2$			1½	209574.28	24.02
$^4P_3$			2½	209620.36	46.08
$4p'\ ^2P_1$	$2s\,2p(^3P^\circ)4p$	$4p\ ^2P$	½	214406.6	
$^2P_2$			1½	214429.7	23.1
$4p'\ ^4D_1$	$2s\,2p(^3P^\circ)4p$	$4p\ ^4D$	½	214758.3	
$^4D_2$			1½	214772.6	14.3
$^4D_3$			2½	214794.6	22.0
$^4D_4$			3½	214828.0	33.4
$4p'\ ^4S_2$	$2s\,2p(^3P^\circ)4p$	$4p\ ^4S$	1½	215765.6	
	$2s\,2p(^3P^\circ)4p$	$4p\ ^4P$	½		
$4p'\ ^4P_2$			1½	216378.0	19.7
$^4P_3$			2½	216397.7	
	$2s\,2p(^3P^\circ)4p$	$4p\ ^2D$	1½		
$4p'\ ^2D_3$			2½	216927	
$4d'\ ^4F_2$	$2s\,2p(^3P^\circ)4d$	$4d\ ^4F^\circ$	1½	219553.8	
$^4F_3$			2½	219568.5	14.7
$^4F_4$			3½	219589.2	20.7
$^4F_5$			4½	219617.0	27.8
	$2s\,2p(^3P^\circ)4d$	$4d\ ^4D^\circ$	½		
$4d'\ ^4D_2$			1½	220127.8	9.2
$^4D_3$			2½	220137.0	10.6
$^4D_4$			3½	220147.6	
$4d'\ ^2D_2$	$2s\,2p(^3P^\circ)4d$	$4d\ ^2D^\circ$	1½	220601.1	
$^2D_3$			2½	220614.2	13.1
$4d'\ ^4P_3$	$2s\,2p(^3P^\circ)4d$	$4d\ ^4P^\circ$	2½	220808.47	
$^4P_2$			1½	220828.97	−20.50
$^4P_1$			½	220840.87	−11.90
$4f'\ ^2F_3$	$2s\,2p(^3P^\circ)4f$	$4f\ ^2F$	2½	221089.6	
$^2F_4$			3½	221098.8	9.2
	$2s\,2p(^3P^\circ)4f$	$4f\ ^4F$	1½		
			2½		
$4f'\ ^4F_4$			3½	221106.3	
$^4F_5$			4½	221107.4	1.1

C II—Continued

Edlén	Config.	Desig.	J	Level	Interval
$4d'\ ^2F_4$	$2s\,2p(^3P^\circ)4d$	$4d\ ^2F^\circ$	2½		
			3½	221502	
$4f'\ ^4G_3$	$2s\,2p(^3P^\circ)4f$	$4f\ ^4G$	2½	221543.0	
$^4G_4$			3½	221553.2	10.2
$^4G_5$			4½	221574.5	21.3
$^4G_6$			5½	221603.6	29.1
$4f'\ ^2G_4$	$2s\,2p(^3P^\circ)4f$	$4f\ ^2G$	3½	221585	
$^2G_5$			4½	221628	43
$4f'\ ^4D_4$	$2s\,2p(^3P^\circ)4f$	$4f\ ^4D$	3½	221696.5	
$^4D_3$			2½	221727.4	−30.9
$^4D_2$			1½	221746.3	−18.9
			½		
$4f'\ ^2D_3$	$2s\,2p(^3P^\circ)4f$	$4f\ ^2D$	2½	221707.9	
$^2D_2$			1½	221752.9	−45.0
$4d'\ ^2P_2$	$2s\,2p(^3P^\circ)4d$	$4d\ ^2P^\circ$	1½	222259.1	
$^2P_1$			½	222286.0	−26.9
	$2s\,2p(^3P^\circ)5s$	$5s\ ^4P^\circ$	½		
			1½		
$5s'\ ^4P_3$			2½	225813	
$5p'\ ^2P$	$2s\,2p(^3P^\circ)5p$	$5p\ ^2P$	{ ½ 1½ }	227901	
	$2s\,2p(^3P^\circ)5d$	$5d\ ^4D^\circ$	½		
			1½		
			2½		
$5d'\ ^4D_4$			3½	230763	
$5d'\ ^4P_3$	$2s\,2p(^3P^\circ)5d$	$5d\ ^4P^\circ$	2½	231050	
			1½		
			½		
$5f'\ ^2F$	$2s\,2p(^3P^\circ)5f$	$5f\ ^2F$	{ 2½ 3½ }	231221	
	$2s\,2p(^3P^\circ)5f$	$5f\ ^4F$	1½		
			2½		
			3½		
$5f'\ ^4F_5$			4½	231226.8	
	$2s\,2p(^3P^\circ)5f$	$5f\ ^4G$	2½		
			3½		
			4½		
$5f'\ ^4G_6$			5½	231499.3	
$5f'\ ^4D_4$	$2s\,2p(^3P^\circ)5f$	$5f\ ^4D$	3½	231520.4	
			2½		
			1½		
			½		
	$2s\,2p(^3P^\circ)6d$	$6d\ ^4D^\circ$	½		
			1½		
			2½		
$6d'\ ^4D_4$			3½	236444	
$6d'\ ^4P_3$	$2s\,2p(^3P^\circ)6d$	$6d\ ^4P^\circ$	2½	236605	
			1½		
			½		

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Config. 1s²+	Observed Terms			
2s²(¹S)2p	2p ²P°			
2s 2p²	{ 2p² ²S	2p² ⁴P 2p² ²P	2p² ²D	
2p³	{ 2p³ ⁴S°	2p³ ²P°	2p³ ²D°	

	ns (n≥3)	np (n≥3)	nd (n≥3)	nf (n≥4)
2s²(¹S)nx	3–6s ²S	3–5p ²P°	3–6d ²D	4–6f ²F°
2s 2p(³P°)nx	{ 3–5s ⁴P° 3s ²P°	3, 4p ⁴S 3, 4p ⁴P 3, 4p ⁴D 3p ²S 3, 5p ²P 3, 4p ²D	3–6d ⁴P° 3–6d ⁴D° 3, 4d ⁴F° 3, 4d ²P° 3, 4d ²D° 3, 4d ²F°	4, 5f ⁴D 4, 5f ⁴F 4, 5f ⁴G 4f ²D 4, 5f ²F 4f ²G

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

C III

SEE REVISION IN NSRDS-NBS 3, Section 3, October 1970.

(Be I sequence; 4 electrons) $Z=6$

Ground state $1s^2\,2s^2\,{}^1S_0$

$2s^2\ {}^1S_0$ 386159. 7 cm^{-1} I. P. 47.864 volts

All but three terms are from Edlén's Monograph. For the terms $7d\ ^3D$, $8d\ ^3D$, and $9d\ ^3D$ the revised values of Whitelaw and Mack have been used. Edlén has since rejected his $4d'\ ^1P$ term.

No intersystem combinations have been found with certainty. The long D-series determine the limits to about ±25 cm^{-1}. The uncertainty x in the relative positions of the singlets and triplets is, therefore, less than ±50 cm^{-1} according to Edlén. No trace of the line predicted at 1910.7 ±2 A, $2s^2\ {}^1S_0-2p\ {}^3P_1^\circ$, is visible on his plates. A line observed at 339 A (294314.1 cm^{-1}) agrees within 4 cm^{-1} with the calculated combination $2p\ {}^3P_1^\circ-5d\ {}^1D_2$. This identification is uncertain, since it is not confirmed by other intersystem combinations.

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B. Edlén, private communication (Dec. 1947). (T)

C III   **C III**

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
2s ¹S₀	2s²	2s² ¹S	0	0. 0		2p' ¹D₂	2p²	2p² ¹D	2	145875. 1	
2p ³P₀ ³P₁ ³P₂	2s(²S)2p	2p ³P°	0 1 2	52315. 0+x 52338. 0+x 52394. 8+x	23. 0 56. 8	2p' ¹S₀	2p²	2p² ¹S	0	182520. 2	
						3s ³S₁	2s(²S)3s	3s ³S	1	238160. 7+x	
2p ¹P₁	2s(²S)2p	2p ¹P°	1	102351. 4		3s ¹S₀	2s(²S)3s	3s ¹S	0	247169. 5	
2p' ³P₀ ³P₁ ³P₂	2p²	2p² ³P	0 1 2	137374. 0+x 137403. 4+x 137450. 5+x	29. 4 47. 1	3p ¹P₁	2s(²S)3p	3p ¹P°	1	258931. 4	

C III—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3p\ ^3P_0$	$2s(^2S)3p$	$3p\ ^3P^\circ$	0	259653.8+x	5.5
$^3P_1$			1	259659.3+x	12.8
$^3P_2$			2	259672.1+x	
$3d\ ^3D_1$	$2s(^2S)3d$	$3d\ ^3D$	1	269957.6+x	2.1
$^3D_2$			2	269959.7+x	3.2
$^3D_3$			3	269962.9+x	
$3d\ ^1D_2$	$2s(^2S)3d$	$3d\ ^1D$	2	276482.7	
$3s'\ ^3P_0$	$2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0	308162.9+x	33.3
$^3P_1$			1	308196.2+x	68.6
$^3P_2$			2	308264.8+x	
$4s\ ^3S_1$	$2s(^2S)4s$	$4s\ ^3S$	1	309404.5+x	
$3s'\ ^1P_1$	$2p(^2P^\circ)3s$	$3s\ ^1P^\circ$	1	310005.2	
$4s\ ^1S_0$	$2s(^2S)4s$	$4s\ ^1S$	0	311720.7	
$4p\ ^3P_{01}$	$2s(^2S)4p$	$4p\ ^3P^\circ$	0, 1	317743+x	5
$^3P_2$			2	317748+x	
$3p'\ ^1P_1$	$2p(^2P^\circ)3p$	$3p\ ^1P$	1	319719.4	
$4d\ ^3D_1$	$2s(^2S)4d$	$4d\ ^3D$	1	321358.8+x	16.3
$^3D_2$			2	321375.1+x	23.5
$^3D_3$			3	321398.6+x	
$4f\ ^3F_2$	$2s\ (^2S)4f$	$4f\ ^3F^\circ$	2	321949.1+x	6.7
$^3F_3$			3	321955.8+x	8.9
$^3F_4$			4	321964.7+x	
$4p\ ^1P_1$	$2s(^2S)4p$	$4p\ ^1P^\circ$	1	322403.1	
$4f\ ^1F_3$	$2s(^2S)4f$	$4f\ ^1F^\circ$	3	322701.1	
$3p'\ ^3D_1$	$2p(^2P^\circ)3p$	$3p\ ^3D$	1	323024.0+x	25.4
$^3D_2$			2	323049.4+x	38.8
$^3D_3$			3	323088.2+x	
$4d\ ^1D_2$	$2s(^2S)4d$	$4d\ ^1D$	2	324212.0	
$3p'\ ^3S_1$	$2p(^2P^\circ)3p$	$3p\ ^3S$	1	327225.7+x	
$3p'\ ^3P_0$	$2p(^2P^\circ)3p$	$3p\ ^3P$	0	329633.1+x	21.1
$^3P_1$			1	329654.2+x	36.7
$^3P_2$			2	329690.9+x	
$3d'\ ^1D_2$	$2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	332690.3	
$3p'\ ^1D_2$	$2p(^2P^\circ)3p$	$3p\ ^1D$	2	333116.4	
$3d'\ ^3F_2$	$2p(^2P^\circ)3d$	$3d\ ^3F^\circ$	2	333333.4+x	25.0
$^3F_3$			3	333358.4+x	36.6
$^3F_4$			4	333395.0+x	
$3d'\ ^3D_1$	$2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	337602.9+x	13.5
$^3D_2$			2	337616.4+x	20.3
$^3D_3$			3	337636.7+x	
$5s\ ^3S_1$	$2s(^2S)5s$	$5s\ ^3S$	1	339881+x	
$3d'\ ^3P_2$	$2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	340049.5+x	−26.3
$^3P_1$			1	340075.8+x	−14.5
$^3P_0$			0	340090.3+x	
$3d'\ ^1F_3$	$2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	341368.5	
$5p\ ^1P_1$	$2s(^2S)5p$	$5p\ ^1P^\circ$	1	343255.7	
	$2s(^2S)5p$	$5p\ ^3P^\circ$	0		
			1		
$5p\ ^3P_2$			2	344181+x	
$3p'\ ^1S_0$	$2p(^2P^\circ)3p$	$3p\ ^1S$	0	345093.9	

C III—Continued

Edlén	Config.	Desig.	J	Level	Interval
	$2s(^2S)5d$	$5d\ ^3D$	1		
			2		
$5d\ ^3D_3$			3	345444+x	
	$2s(^2S)5g$	$5g\ ^3G$	3		
$5g\ ^3G_4$			4	346525.1+x	0.9
$^3G_5$			5	346526.0+x	
$5g\ ^1G_4$	$2s(^2S)5g$	$5g\ ^1G$	4	346577.5	
$5d\ ^1D_2$	$2s(^2S)5d$	$5d\ ^1D$	2	346656.0	
$3d'\ ^1P_1$	$2p(^2P^\circ)3d$	$3d\ ^1P^\circ$	1	346713.1	
$5f\ ^3F_2$	$2s(^2S)5f$	$5f\ ^3F^\circ$	2	347099.5+x	1.8
$^3F_3$			3	347101.3+x	2.4
$^3F_4$			4	347103.7+x	
$5f\ ^1F_3$	$2s(^2S)5f$	$5f\ ^1F^\circ$	3	348859.5	
$6s\ ^3S_1$	$2s(^2S)6s$	$6s\ ^3S$	1	354796+x	
$6p\ ^1P_1$	$2s(^2S)6p$	$6p\ ^1P^\circ$	1	357088	
	$2s(^2S)6d$	$6d\ ^3D$	1		
			2		
$6d\ ^3D_3$			3	358046+x	
	$2s(^2S)6g$	$6g\ ^3G$	3		
$6g\ ^3G_4$			4	358638.3+x	0.7
$^3G_5$			5	358639.0+x	
$6g\ ^1G_4$	$2s(^2S)6g$	$6g\ ^1G$	4	358688.9	
$6d\ ^1D_2$	$2s(^2S)6d$	$6d\ ^1D$	2	358725.5	
	$2s(^2S)6f$	$6f\ ^3F^\circ$	2		
			3		
$6f\ ^3F_4$			4	358800+x	
$6f\ ^1F_3$	$2s(^2S)6f$	$6f\ ^1F^\circ$	3	359122.2	
$7s\ ^3S_1$	$2s(^2S)7s$	$7s\ ^3S$	1	363561+x	
$7p\ ^1P_1$	$2s(^2S)7p$	$7p\ ^1P^\circ$	1	364896	
$7d\ ^3D$	$2s(^2S)7d$	$7d\ ^3D$	1, 2, 3	365585+x	
$7d\ ^1D_2$	$2s(^2S)7d$	$7d\ ^1D$	2	366027.0	
$8p\ ^1P_1$	$2s(^2S)8p$	$8p\ ^1P^\circ$	1	369926	
$8d\ ^3D$	$2s(^2S)8d$	$8d\ ^3D$	1, 2, 3	370438+x	
$9d\ ^3D$	$2s(^2S)9d$	$9d\ ^3D$	1, 2, 3	373748+x	
	$2p(^2P^\circ)4s$	$4s\ ^3P^\circ$	0		
			1		
$4s'\ ^3P_2$			2	376637+x	
$4p'\ ^1P_1$	$2p(^2P^\circ)4p$	$4p\ ^1P$	1	381104.8	
	$2p(^2P^\circ)4p$	$4p\ ^3D$	1		
$4p'\ ^3D_2$			2	381919+x	39
$^3D_3$			3	381958+x	
	$2p(^2P^\circ)4p$	$4p\ ^3P$	0		
$4p'\ ^3P_1$			1	384313+x	37
$^3P_2$			2	384350+x	
$4p'\ ^1D_2$	$2p(^2P^\circ)4p$	$4p\ ^1D$	2	385637.5	
$4d'\ ^1D_2$	$2p(^2P^\circ)4d$	$4d\ ^1D^\circ$	2	385816.2	
C IV ($^2S_{1/2}$)	*Limit*	------		386159.7	

Edlén	Config.	Desig.	J	Level	Interval
	$2p(^2P°)4d$	$4d\ ^3D°$	1 2 3	 *387646* $+x$	
4d′ ³D₃					
4d′ ³P₂	$2p(^2P°)4d$	$4d\ ^3P°$	2 1 0	*388442* $+x$	
4d′ ¹F₃	$2p(^2P°)4d$	$4d\ ^1F°$	3	*388772. 2*	
5p′ ¹P₁	$2p(^2P°)5p$	$5p\ ^1P$	1	407430. 4	
	$2p(^2P°)5p$	$5p\ ^3D$	1 2 3	 407774 $+x$	
5p′ ³D₃					
	$2p(^2P°)5p$	$5p\ ^3P$	0 1 2	 408873 $+x$	
5p′ ³P₂					
5p′ ¹D₂	$2p(^2P°)5p$	$5p\ ^1D$	2	409505. 0	
5d′ ¹D₂	$2p(^2P°)5d$	$5d\ ^1D°$	2	409682. 1	
	$2p(^2P°)5d$	$5d\ ^3D°$	1 2 3	 *410534* $+x$	
5d′ ³D₃					

Edlén	Config.	Desig.	J	Level	Interval
5d′ ³P₂	$2p(^2P°)5d$	$5d\ ^3P°$	2 1 0	*410841* $+x$	
	$2p(^2P°)6p$	$6p\ ^3D$	1 2 3	 421380 $+x$	
6p′ ³D₃					
	$2p(^2P°)6p$	$6p\ ^3P$	0 1 2	 421967 $+x$	
6p′ ³P₂					
	$2p(^2P°)6d$	$6d\ ^3D°$	1 2 3	 *422881* $+x$	
6d′ ³D₃					
6d′ ³P₂	$2p(^2P°)6d$	$6d\ ^3P°$	2 1 0	*423058* $+x$	
	$2p(^2P°)7p$	$7p\ ^3D$	1 2 3	 429345 $+x$	
7p′ ³D₃					
	$2p(^2P°)7p$	$7p\ ^3P$	0 1 2	 429712 $+x$	
7p′ ³P₂					

December 1947.

C III Observed Terms*

Config. $1s^2+$	Observed Terms				
$2s^2$	$2s^2\ ^1S$				
$2s(^2S)2p$	{ $2p\ ^3P°$ $2p\ ^1P°$				
$2p^2$	{ $2p^2\ ^1S$ $2p^2\ ^3P$ $2p^2\ ^1D$				

	$ns\ (n\ge 3)$	$np\ (n\ge 3)$	$nd\ (n\ge 3)$	$nf\ (n\ge 4)$	$ng\ (n\ge 5)$
$2s(^2S)nx$	{3–7s ³S {3, 4s ¹S	3–5p ³P° 3–8p ¹P°	3–9d ³D 3–7d ¹D	4–6f ³F° 4–6f ¹F°	5, 6g ³G 5, 6g ¹G
$2p(^2P°)nx$	{ 3, 4s ³P° 3s ¹P°	3p ³S 3–7p ³P 3–7p ³D 3p ¹S 3–5p ¹P 3–5p ¹D	3–6d ³P° 3–6d ³D° 3d ³F° 3d ¹P° 3–5d ¹D° 3, 4d ¹F°		

*For predicted terms of the Be ɪ isoelectronic sequence, see Introduction.

C IV

(Li I sequence; 3 electrons)　　　　　　　　　　　　　　　　　　　　　　　　$Z=6$

Ground state $1s^2\ 2s\ {}^2S_{\frac{1}{2}}$

$2s\ {}^2S_{\frac{1}{2}}$ **520177.8 cm⁻¹**　　　　　　　　　　　　　　　　　　I. P. 64.476 volts

The terms are from Edlén. His extrapolated values of three intervals and the term values of the two high series members $8f\ {}^2F°$ and $8g\ {}^2G$, etc., which were calculated from a well-determined series formula, are entered in brackets in the table.

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T.-Y. Wu, Phys. Rev. **58**, 1114 (1940).　(C L)

C IV

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
$2s\ {}^2S_1$	$2s$	$2s\ {}^2S$	½	0. 0		$6d\ {}^2D$	$6d$	$6d\ {}^2D$	{ 1½ 2½ }	471368	
$2p\ {}^2P_1$ ${}^2P_2$	$2p$	$2p\ {}^2P°$	½ 1½	64484. 2 64591. 3	[107. 1	$6f\ {}^2F$	$6f$	$6f\ {}^2F°$	{ 2½ 3½ }	471403. 0	
$3s\ {}^2S_1$	$3s$	$3s\ {}^2S$	½	302847. 9		$6g\ {}^2G$	$6g$	$6g\ {}^2G$	{ 3½ 4½ }	471407. 4	
$3p\ {}^2P_1$ ${}^2P_2$	$3p$	$3p\ {}^2P°$	½ 1½	320048. 5 320080. 0	[31. 5	$6h\ {}^2H$	$6h$	$6h\ {}^2H°$	{ 4½ 5½ }	471407. 9	
$3d\ {}^2D_2$ ${}^2D_3$	$3d$	$3d\ {}^2D$	1½ 2½	324880. 2 324890. 9	[10. 7]	$7s\ {}^2S_1$	$7s$	$7s\ {}^2S$	½	482659	
$4s\ {}^2S_1$	$4s$	$4s\ {}^2S$	½	401346. 7		$7p\ {}^2P$	$7p$	$7p\ {}^2P°$	{ ½ 1½ }	483931	
$4p\ {}^2P_1$ ${}^2P_2$	$4p$	$4p\ {}^2P°$	½ 1½	408308. 9 408322. 2	13. 3	$7d\ {}^2D$	$7d$	$7d\ {}^2D$	{ 1½ 2½ }	484309	
$4d\ {}^2D_2$ ${}^2D_3$	$4d$	$4d\ {}^2D$	1½ 2½	410333. 8 410338. 2	4. 4	$7f\ {}^2F$	$7f$	$7f\ {}^2F°$	{ 2½ 3½ }	484343. 8	
$4f\ {}^2F_4$	$4f$	$4f\ {}^2F°$	2½ 3½	410434. 1	[2. 1]	$7g\ {}^2G$	$7g$	$7g\ {}^2G$	{ 3½ 4½ }	484346. 6	
$5s\ {}^2S_1$	$5s$	$5s\ {}^2S$	½	445366. 1		$7h\ {}^2H$	$7h$	$7h\ {}^2H°$	{ 4½ 5½ }	484346. 9	
$5p\ {}^2P_1$ ${}^2P_2$	$5p$	$5p\ {}^2P°$	½ 1½	448854 448861	[6. 7]	$8p\ {}^2P$	$8p$	$8p\ {}^2P°$	{ ½ 1½ }	492473	
$5d\ {}^2D_3$	$5d$	$5d\ {}^2D$	1½ 2½	449887. 4	[2. 2]	$8F$	$8f$	$8f\ {}^2F°$	{ 2½ 3½ }	[492743]	
$5f\ {}^2F$	$5f$	$5f\ {}^2F°$	{ 2½ 3½ }	449938. 2		$8GHIK$	$8g$, etc.	$8g{}^2G$, etc.	{ 3½ to 7½ }	[492745]	
$5g\ {}^2G$	$5g$	$5g\ {}^2G$	{ 3½ 4½ }	449948. 4							
$6s\ {}^2S_1$	$6s$	$6s\ {}^2S$	½	468765		C v (${}^1S_0$)		*Limit*	------	520177. 8	
$6p\ {}^2P$	$6p$	$6p\ {}^2P°$	{ ½ 1½ }	470763							

C v

(He I sequence; 2 electrons) $Z=6$

Ground state $1s^2\ ^1S_0$

$1s^2\ ^1S_0$ **3162450±300 cm⁻¹**   I. P. 391.986±0.037 volts

The singlet terms are from Tyrén, who has reported (1940) nine lines visible on his spectrograms. His limit has been calculated from the series members $n=2$ to 6. The remaining singlet terms have been calculated from three classified lines at 32 A given in his 1936 paper. He has also classified a line at 40.731 A as the intersystem combination $1s^2\ ^1S_0-2p\ ^3P_1^\circ$. His unit, 10^3 cm⁻¹ has here been changed to cm⁻¹.

The triplet terms are from an unpublished manuscript kindly furnished by Edlén, who states that the absolute term values of the triplets are based on an extrapolation of $3d\ ^3D$ from He I and Li II. The relative positions of the singlet and triplet terms thus determined confirm the intersystem combination reported by Tyrén.

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B. Edlén, unpublished material (Sept. 1947). (T)

	C v						C v			
Config.	Desig.	J	Level	Interval		Config.	Desig.	J	Level	Interval
$1s^2$	$1s^2\ ^1S$	0	0			1s 4p	$4p\ ^1P^\circ$	1	2991680	
1s 2s	$2s\ ^3S$	1	2411266			1s 5p	$5p\ ^1P^\circ$	1	3053060	
1s 2p	$2p\ ^3P^\circ$	0	2455165	−13		1s 6p	$6p\ ^1P^\circ$	1	3086420	
		1	2455152	136		1s 7p	$7p\ ^1P^\circ$	1	3106750	
		2	2455288							
1s 2p	$2p\ ^1P^\circ$	1	2483240			1s 8p	$8p\ ^1P^\circ$	1	3118760	
1s 3d	$3d\ ^3D$	3, 2, 1	2857308							
1s 3p	$3p\ ^1P^\circ$	1	2859350			C VI ($^2S_{1/2}$)	*Limit*		3162450	

September 1947.

C VI

(H sequence; 1 electron) $Z=6$

Ground state $1s\ ^2S_{1/2}$

$1s\ ^2S_{1/2}$ **3951950** cm^{-1} I. P. 489.84 volts

The first three members of the Lyman series have been observed by Tyrén. The terms listed below have been calculated by J. E. Mack, "using $R_{C^{12}}=109732.286$ and $\Lambda=0.040$. The series limit of C^{13} is higher by 14.0 cm^{-1} than the one shown here."

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J. E. Mack, unpublished material (1949).   (I P) (T) (C L)

C VI   C VI

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$1s$	$1s\ ^2S$	½	0		$4p$	$4p\ ^2P°$	½	3704957	⎤⎤ 5
					$4s$	$4s\ ^2S$	½	3704961	⎦ 59. 2
$2p$	$2p\ ^2P°$	½	2963768	⎤⎤ 38	$4p, 4d$	$4d\ ^2D, 4p\ ^2P°$	1½	3705016	19. 7
$2s$	$2s\ ^2S$	½	2963806	⎦ 473. 3	$4d, 4f$	$4d\ ^2D, 4f\ ^2F°$	2½	3705035	9. 9
$2p$	$2p\ ^2P°$	1½	2964241		$4f$	$4f\ ^2F°$	3½	3705045	
$3p$	$3p\ ^2P°$	½	3512811	⎤⎤ 11	$5s$, etc.	$5s\ ^2S$, etc.	½, etc.	3793884	
$3s$	$3s\ ^2S$	½	3512822	⎦ 140. 3				to 933	
$3p, 3d$	$3d\ ^2D, 3p\ ^2P°$	1½	3512951	46. 7					
$3d$	$3d\ ^2D$	2½	3512998		$\infty=$ *Limit*			**3951950**	

February 1949.

NITROGEN

N I

7 electrons $\qquad\qquad$ Z=7

Ground state $1s^2\ 2s^2\ 2p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$2p^3\ {}^4S^\circ_{1\frac{1}{2}}\ \mathit{117345}$ cm^{-1} $\qquad\qquad$ I. P. 14.54 volts

The terms have been taken chiefly from the list prepared by Ekefors with extensions calculated from the classifications published in Tokyo. Unfortunately, no term list was included in the Tokyo papers. Consequently, considerable editing has been done in compiling terms from all the observational material. Revised values are suggested for a few levels and tentative values not in the literature are listed for $5d\ {}^4F_{2\frac{1}{2}}$, $5d\ {}^4F_{1\frac{1}{2}}$, $5d\ {}^4D_{3\frac{1}{2}}$, and $6d\ {}^4D_{3\frac{1}{2}}$. Further study is needed to verify the numerous blends resulting from practically coincident levels.

Intersystem combinations have been observed.

Kiess and Shortley have generously furnished g-values derived from the observed Zeeman effects of 18 infrared lines.

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N I						N I					
Config.	Desig.	J	Level	Interval	Obs. g	Config.	Desig.	J	Level	Interval	Obs. g
$2s^2\ 2p^3$	$2p^3\ {}^4S^\circ$	$1\frac{1}{2}$	$\mathit{0}$			$2s\ 2p^4$	$2p^4\ {}^4P$	$2\frac{1}{2}$	88109. 5	$-43.\,9$	
								$1\frac{1}{2}$	88153. 4	$-19.\,6$	
$2s^2\ 2p^3$	$2p^3\ {}^2D^\circ$	$2\frac{1}{2}$	$\mathit{19223}$					$\frac{1}{2}$	88173. 0		
		$1\frac{1}{2}$	$\mathit{19231}$	-8		$2s^2\ 2p^2({}^3P)3p$	$3p\ {}^2S^\circ$	$\frac{1}{2}$	$\mathit{93582.\,3}$		
$2s^2\ 2p^3$	$2p^3\ {}^2P^\circ$	$\left\{\begin{array}{l}1\frac{1}{2}\\ \frac{1}{2}\end{array}\right\}$	$\mathit{28840}$			$2s^2\ 2p^2({}^3P)3p$	$3p\ {}^4D^\circ$	$\frac{1}{2}$	$\mathit{94772.\,2}$		0. 002
								$1\frac{1}{2}$	$\mathit{94794.\,8}$	22. 6	1. 19
$2s^2\ 2p^2({}^3P)3s$	$3s\ {}^4P$	$\frac{1}{2}$	83285. 5	33. 8	2. 670			$2\frac{1}{2}$	$\mathit{94832.\,1}$	37. 3	1. 36
		$1\frac{1}{2}$	83319. 3	46. 7	1. 735			$3\frac{1}{2}$	$\mathit{94883.\,1}$	51. 0	1. 44
		$2\frac{1}{2}$	83366. 0		1. 603	$2s^2\ 2p^2({}^3P)3p$	$3p\ {}^4P^\circ$	$\frac{1}{2}$	$\mathit{95476.\,5}$		2. 671
$2s^2\ 2p^2({}^3P)3s$	$3s\ {}^2P$	$\frac{1}{2}$	86131. 4	91. 8				$1\frac{1}{2}$	$\mathit{95494.\,9}$	18. 4	1. 737
		$1\frac{1}{2}$	86223. 2					$2\frac{1}{2}$	$\mathit{95533.\,2}$	38. 3	1. 598

Config.	Desig.	J	Level	Interval	Obs. g
$2s^2\,2p^2(^3P)3p$	$3p\ ^4S^\circ$	1½	96751.7		2.004
$2s^2\,2p^2(^3P)3p$	$3p\ ^2D^\circ$	1½	96788.2	76.0	
		2½	96864.2		
$2s^2\,2p^2(^3P)3p$	$3p\ ^2P^\circ$	½	97770.1	35.7	
		1½	97805.8		
$2s^2\,2p^2(^1D)3s$	$3s'\ ^2D$	2½	99665	−7	
		1½	99658		
$2s^2\,2p^2(^3P)4s$	$4s\ ^4P$	½	103618.1	50.0	
		1½	103668.1	68.7	
		2½	103736.8		
$2s^2\,2p^2(^3P)4s$	$4s\ ^2P$	½	104142.2	85.2	
		1½	104227.4		
$2s^2\,2p^2(^3P)3d$	$3d\ ^2P$	1½	104615.4	−39.5	
		½	104654.9		
$2s^2\,2p^2(^3P)3d$	$3d\ ^4F$	1½	104665	19	
		2½	104684	34	
		3½	104718	49	
		4½	104767		
$2s^2\,2p^2(^3P)3d$	$3d\ ^2F$	2½	104810.9	71.8	
		3½	104882.7		
$2s^2\,2p^2(^3P)3d$	$3d\ ^4P$	½	104864	26	
		1½	104890	67	
		2½	104957		
$2s^2\,2p^2(^3P)3d$	$3d\ ^4D$	½	104987	11	
		1½	104998	13	
		2½	105011	9	
		3½	105020		
$2s^2\,2p^2(^3P)3d$	$3d\ ^2D$	1½	105120.8	23.5	
		2½	105144.3		
$2s^2\,2p^2(^3P)4p$	$4p\ ^2S^\circ$	½	106478.6		
$2s^2\,2p^2(^3P)4p$	$4p\ ^4D^\circ$	½	106760.5	19.6	
		1½	106780.1	36.0	
		2½	106816.1	54.6	
		3½	106870.7		
$2s^2\,2p^2(^3P)4p$	$4p\ ^4P^\circ$	½	106982.7	15.6	
		1½	106998.3	40.7	
		2½	107039.0		
$2s^2\,2p^2(^3P)4p$	$4p\ ^4S^\circ$	1½	107447.2		
$2s^2\,2p^2(^3P)5s$	$5s\ ^4P$	½	109813.5	44.3	
		1½	109857.8	70.1	
		2½	109927.9		
$2s^2\,2p^2(^3P)5s$	$5s\ ^2P$	½	110029.2	79.3	
		1½	110108.5		
$2s^2\,2p^2(^3P)4d$	$4d\ ^4F$	1½	110196	18	
		2½	110214	34	
		3½	110248	56	
		4½	110304		
$2s^2\,2p^2(^3P)4d$	$4d\ ^4D$	½	110221	54	
		1½	110275	13	
		2½	110288	51	
		3½	110339		
$2s^2\,2p^2(^3P)4d$	$4d\ ^2P$	1½	110221.7	−22.9	
		½	110244.6		
$2s^2\,2p^2(^3P)4d$	$4d\ ^2F$	2½	110311	62	
		3½	110373		
$2s^2\,2p^2(^3P)4d$	$4d\ ^4P$	½	110325	26	
		1½	110351	52	
		2½	110403		
$2s^2\,2p^2(^3P)4d$	$4d\ ^2D$	1½	110448.3	22.2	
		2½	110470.5		
$2s^2\,2p^2(^1D)3p$	$3p'\ ^2D^\circ$	1½	110521.9	23.9	
		2½	110545.8		
$2s^2\,2p^2(^1D)3p$	$3p'\ ^2P^\circ$	½	112294.8	26.0	
		1½	112320.8		
$2s^2\,2p^2(^3P)6s$	$6s\ ^4P$	½	112565.9	44.7	
		1½	112610.6	72.0	
		2½	112682.6		
$2s^2\,2p^2(^3P)6s$	$6s\ ^2P$	½	112735	88	
		1½	112823		
$2s^2\,2p^2(^3P)5d$	$5d\ ^4F$	1½	112751?	12	
		2½	112763?	36	
		3½	112799	63	
		4½	112862		
$2s^2\,2p^2(^3P)5d$	$5d\ ^2P$	1½	112801	−15	
		½	112816		
$2s^2\,2p^2(^3P)5d$	$5d\ ^2F$	2½	112820	70	
		3½	112890.2		
$2s^2\,2p^2(^3P)5d$	$5d\ ^4D$	½			
		1½			
		2½	112825	67	
		3½	112892?		
$2s^2\,2p^2(^3P)5d$	$5d\ ^4P$	½	112855	19	
		1½	112874	38	
		2½	112912		
$2s^2\,2p^2(^3P)5d$	$5d\ ^2D$	1½	112929.2	18.3	
		2½	112947.5		
$2s^2\,2p^2(^3P)7s$	$7s\ ^4P$	½	114015?	57	
		1½	114072?	74	
		2½	114146		
$2s^2\,2p^2(^3P)7s$	$7s\ ^2P$	½	114130	33	
		1½	114163		
$2s^2\,2p^2(^3P)6d$	$6d\ ^4F$	1½ to 4½	114160		
$2s^2\,2p^2(^3P)6d$	$6d\ ^4D$	½			
		1½			
		2½	114182	66	
		3½	114248?		
$2s^2\,2p^2(^3P)6d$	$6d\ ^2P$	1½	114193	−16	
		½	114209		
$2s^2\,2p^2(^3P)6d$	$6d\ ^2F$	2½	114196	79	
		3½	114275		
$2s^2\,2p^2(^3P)6d$	$6d\ ^2D$	1½	114232.2	58.3	
		2½	114290.5		
$2s^2\,2p^2(^3P)6d$	$6d\ ^4P$	½			
		1½	114259	15	
		2½	114274		
$2s^2\,2p^2(^3P)8s$	$8s\ ^4P$	½	114809	81	
		1½	114890	52	
		2½	114942		

Config.	Desig.	J	Level	Interval	Obs. g
$2s^2\,2p^2(^3P)8s$	$8s\ ^2P$	½, 1½	114950		
$2s^2\,2p^2(^3P)7d$	$7d\ ^4D$	½ to 3½	114988		
$2s^2\,2p^2(^3P)7d$	$7d\ ^2F$	2½, 3½	115004		
$2s^2\,2p^2(^3P)7d$	$7d\ ^2P$	1½, ½	115017		
$2s^2\,2p^2(^3P)7d$	$7d\ ^2D$	1½, 2½	115057.5, 115100.1	42.6	
$2s^2\,2p^2(^3P)7d$	$7d\ ^4P$	½, 1½, 2½	115103		
$2s^2\,2p^2(^3P)9s$	$9s\ ^2P$	½, 1½	115480		
$2s^2\,2p^2(^3P)9s$	$9s\ ^4P$	½ to 2½	115483		
$2s^2\,2p^2(^3P)8d$	$8d\ ^4D$	½ to 3½	115524		
$2s^2\,2p^2(^3P)8d$	$8d\ ^2P$	1½, ½	115530		
$2s^2\,2p^2(^3P)8d$	$8d\ ^2F$	2½, 3½	115535		
$2s^2\,2p^2(^3P)8d$	$8d\ ^2D$	1½, 2½	115597, 115622	25	
$2s^2\,2p^2(^3P)8d$	$8d\ ^4P$	½ to 2½	115618		
$2s^2\,2p^2(^3P)10s$	$10s\ ^2P$	½, 1½	115842		
$2s^2\,2p^2(^3P)10s$	$10s\ ^4P$	½ to 2½	115855		
$2s^2\,2p^2(^3P)9d$	$9d\ ^4D$	½ to 3½	115887		
$2s^2\,2p^2(^3P)9d$	$9d\ ^2P$	1½, ½	115889		
$2s^2\,2p^2(^3P)9d$	$9d\ ^2F$	2½, 3½	115902		
$2s^2\,2p^2(^3P)9d$	$9d\ ^2D$	1½, 2½	115973, 115991	18	
$2s^2\,2p^2(^3P)9d$	$9d\ ^4P$	½ to 2½	115990		

N I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$2s^2\,2p^2(^3P)11s$	$11s\ ^2P$	½, 1½	116107		
$2s^2\,2p^2(^3P)11s$	$11s\ ^4P$	½ to 2½	116124		
$2s^2\,2p^2(^3P)10d$	$10d\ ^2P$	1½, ½	116155		
$2s^2\,2p^2(^3P)10d$	$10d\ ^2F$	2½, 3½	116159		
$2s^2\,2p^2(^3P)10d$	$10d\ ^4D$	½ to 3½	116164		
$2s^2\,2p^2(^3P)10d$	$10d\ ^2D$	1½, 2½	116240		
$2s^2\,2p^2(^3P)10d$	$10d\ ^4P$	½ to 2½	116259		
$2s^2\,2p^2(^3P)12s$	$12s\ ^2P$	½, 1½	116305		
$2s^2\,2p^2(^3P)12s$	$12s\ ^4P$	½ to 2½	116312		
$2s^2\,2p^2(^3P)11d$	$11d\ ^2P$	1½, ½	116351		
$2s^2\,2p^2(^3P)11d$	$11d\ ^2F$	2½, 3½	116359		
$2s^2\,2p^2(^3P)11d$	$11d\ ^4D$	½ to 3½	116367		
$2s^2\,2p^2(^3P)11d$	$11d\ ^2D$	1½, 2½	116436		
$2s^2\,2p^2(^3P)11d$	$11d\ ^4P$	½ to 2½	116441		
$2s^2\,2p^2(^3P)13s$	$13s\ ^2P$	½, 1½	116467		
$2s^2\,2p^2(^3P)12d$	$12d\ ^2P$	1½, ½	116502		
$2s^2\,2p^2(^3P)12d$	$12d\ ^4P$	½ to 2½	116581		
$2s^2\,2p^2(^3P)12d$	$12d\ ^2D$	1½, 2½	116625		
N II $(^3P_0)$	*Limit*	------	*117345*		

October 1947.

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^3$	$\begin{cases}2p^3\ ^4S^\circ\\[2pt]\qquad\quad 2p^3\ ^2P^\circ\quad 2p^3\ ^2D^\circ\end{cases}$		
$2s\,2p^4$	$2p^4\ ^4P$		

	$ns\ (n\ge 3)$	$np\ (n\ge 3)$	$nd\ (n\ge 3)$
$2s^2\,2p^2(^2P)nx$	$\begin{cases}\text{3–12}s\ ^4P\\ \text{3–13}s\ ^2P\end{cases}$	3, 4p ⁴S° 3, 4p ⁴P° 3, 4p ⁴D° 3, 4p ²S° 3p ²P° 3p ²D°	3–12d ⁴P 3–11d ⁴D 3– 6d ⁴F 3–12d ²P 3–12d ²D 3–11d ²F
$2s^2\,2p^2(^1D)nx'$	3s′ ²D	3p′ ²P° 3p′ ²D°	

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

N II

(C I sequence; 6 electrons) $Z=7$

Ground state $1s^2\,2s^2\,2p^2\ ^3P_0$

$2p^2\ ^3P_0$ **238846. 7** cm^{-1} I. P. 29.605 volts

Edlén has revised and extended the earlier analysis of this spectrum. The terms are all taken from his Monograph, except those from the $4f$ configuration, which are from his 1936 paper, and his $3s'\ ^3P$ and $5f$-terms, which he has generously furnished in a private communication.

The singlet and triplet terms are well connected by intersystem combinations but the quintets are not so connected with the others. Edlén also suggests that by analogy with C I and O III the published absolute values of the quintet terms should be decreased by about 500 cm^{-1}. This correction has been applied in the table and should diminish the uncertainty x appreciably.

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Edlén	Config.	Desig.	J	Level	Interval
2p $^3P_0$	$2s^2\,2p^2$	$2p^2\ ^3P$	0	0.0	
$^3P_1$			1	49.1	49.1
$^3P_2$			2	131.3	82.2
2p $^1D_2$	$2s^2\,2p^2$	$2p^2\ ^1D$	2	15315.7	
2p $^1S_0$	$2s^2\,2p^2$	$2p^2\ ^1S$	0	32687.1	
2p′ $^5S_2$	$2s\,2p^3$	$2p^3\ ^5S°$	2	47167.7+x	
2p′ $^3D_3$	$2s\,2p^3$	$2p^3\ ^3D°$	3	92237.9	
$^3D_2$			2	92251.3	−13.4
$^3D_1$			1	92252.9	−1.6
2p′ $^3P_{12}$	$2s\,2p^3$	$2p^3\ ^3P°$	2, 1	109218.2	−6.6
$^3P_0$			0	109224.8	
2p′ $^1D_2$	$2s\,2p^3$	$2p^3\ ^1D°$	2	144189.1	
3s $^3P_0$	$2s^2\,2p(^2P°)3s$	$3s\ ^3P°$	0	148909.37	
$^3P_1$			1	148940.97	31.60
$^3P_2$			2	149077.33	136.36
3s $^1P_1$	$2s^2\,2p(^2P°)3s$	$3s\ ^1P°$	1	149188.74	
2p′ $^3S_1$	$2s\,2p^3$	$2p^3\ ^3S°$	1	155129.9	
3p $^1P_1$	$2s^2\,2p(^2P°)3p$	$3p\ ^1P$	1	164611.60	
3p $^3D_1$	$2s^2\,2p(^2P°)3p$	$3p\ ^3D$	1	166522.48	
$^3D_2$			2	166583.26	60.78
$^3D_3$			3	166679.45	96.19
2p′ $^1P_1$	$2s\,2p^3$	$2p^3\ ^1P°$	1	166765.7	
3p $^3S_1$	$2s^2\,2p(^2P°)3p$	$3p\ ^3S$	1	168893.04	
3p $^3P_0$	$2s^2\,2p(^2P°)3p$	$3p\ ^3P$	0	170573.38	
$^3P_1$			1	170608.63	35.25
$^3P_2$			2	170667.00	58.37
3p $^1D_2$	$2s^2\,2p(^2P°)3p$	$3p\ ^1D$	2	174212.93	
3p $^1S_0$	$2s^2\,2p(^2P°)3p$	$3p\ ^1S$	0	178274.17	
3d $^3F_2$	$2s^2\,2p(^2P°)3d$	$3d\ ^3F°$	2	186512.38	
$^3F_3$			3	186571.80	59.42
$^3F_4$			4	186653.35	81.55
3d $^1D_2$	$2s^2\,2p(^2P°)3d$	$3d\ ^1D°$	2	187092.20	
3d $^3D_1$	$2s^2\,2p(^2P°)3d$	$3d\ ^3D°$	1	187438.34	
$^3D_2$			2	187462.38	24.04
$^3D_3$			3	187492.72	30.34
3d $^3P_2$	$2s^2\,2p(^2P°)3d$	$3d\ ^3P°$	2	188858.09	−51.80
$^3P_1$			1	188909.89	−28.06
$^3P_0$			0	188937.95	
3d $^1F_3$	$2s^2\,2p(^2P°)3d$	$3d\ ^1F°$	3	189336.0	
3d $^1P_1$	$2s^2\,2p(^2P°)3d$	$3d\ ^1P°$	1	190121.15	
4s $^3P_0$	$2s^2\,2p(^2P°)4s$	$4s\ ^3P°$	0	196541.09	
$^3P_1$			1	196592.88	51.79
$^3P_2$			2	196712.17	119.29
4s $^1P_1$	$2s^2\,2p(^2P°)4s$	$4s\ ^1P°$	1	197859.28	
4p $^1P_1$	$2s^2\,2p(^2P°)4p$	$4p\ ^1P$	1	202169.9	
4p $^3D_1$	$2s^2\,2p(^2P°)4p$	$4p\ ^3D$	1	202714.94	
$^3D_2$			2	202765.86	50.92
$^3D_3$			3	202862.06	96.20
4p $^3P_0$	$2s^2\,2p(^2P°)4p$	$4p\ ^3P$	0	203164.7	
$^3P_1$			1	203188.8	24.1
$^3P_2$			2	203259.7	70.9

Edlén	Config.	Desig.	J	Level	Interval
4p $^3S_1$	$2s^2\,2p(^2P°)4p$	$4p\ ^3S$	1	203532.8	
4p $^1D_2$	$2s^2\,2p(^2P°)4p$	$4p\ ^1D$	2	205350.7	
3s′ $^5P_1$	$2s\,2p^2(^4P)3s$	$3s\ ^5P$	1	205982.1+x	
$^5P_2$			2	206038.1+x	56.0
$^5P_3$			3	206108.7+x	70.6
4p $^1S_0$	$2s^2\,2p(^2P°)4p$	$4p\ ^1S$	0	206327.5	
4d $^3F_2$	$2s^2\,2p(^2P°)4d$	$4d\ ^3F°$	2	209675.3	
$^3F_3$			3	209739.5	64.2
$^3F_4$			4	209825.3	85.8
4d $^1D_2$	$2s^2\,2p(^2P°)4d$	$4d\ ^1D°$	2	209926.92	
4d $^3D_1$	$2s^2\,2p(^2P°)4d$	$4d\ ^3D°$	1	210239.8	
$^3D_2$			2	210266.3	26.5
$^3D_3$			3	210301.9	35.6
4d $^3P_2$	$2s^2\,2p(^2P°)4d$	$4d\ ^3P°$	2	210705.4	−46.1
$^3P_1$			1	210751.5	−25.5
$^3P_0$			0	210777.0	
4f $^1F_3$	$2s^2\,2p(^2P°)4f$	$4f\ ^1F$	3	211030.90	
4f $^3F_2$	$2s^2\,2p(^2P°)4f$	$4f\ ^3F$	2	211033.71	23.36
$^3F_3$			3	211057.07	3.96
$^3F_4$			4	211061.03	
4d $^1F_3$	$2s^2\,2p(^2P°)4d$	$4d\ ^1F°$	3	211104.8	
4f $^3G_3$	$2s^2\,2p(^2P°)4f$	$4f\ ^3G$	3	211288.02	7.63
$^3G_4$			4	211295.65	95.12
$^3G_5$			5	211390.77	
4d $^1P_1$	$2s^2\,2p(^2P°)4d$	$4d\ ^1P°$	1	211335.5	
4f $^1G_4$	$2s^2\,2p(^2P°)4f$	$4f\ ^1G$	4	211402.89	
4f $^3D_3$	$2s^2\,2p(^2P°)4f$	$4f\ ^3D$	3	211411.25	−4.95
$^3D_2$			2	211416.20	−71.08
$^3D_1$			1	211487.28	
4f $^1D_2$	$2s^2\,2p(^2P°)4f$	$4f\ ^1D$	2	211491.16	
3s′ $^3P_0$	$2s\,2p^2(^4P)3s$	$3s\ ^3P$	0	211750.2	
$^3P_1$			1	211780.6	30.4
$^3P_2$			2	211828.8	48.2
5s $^3P_0$	$2s^2\,2p(^2P°)5s$	$5s\ ^3P°$	0	214212.4	
$^3P_1$			1	214258.2	45.8
$^3P_3$			2	214385.3	127.1
5s $^1P_1$	$2s^2\,2p(^2P°)5s$	$5s\ ^1P°$	1	214828.0	
	$2s^2\,2p(^2P°)5d$	$5d\ ^3D°$	1		
			2		
5d $^3D_3$			3	220717	
5f $^3F_2$	$2s^2\,2p(^2P°)5f$	$5f\ ^3F$	2		
$^3F_3$			3	221070.2	4.1
$^3F_4$			4	221074.3	
5d $^1F_3$	$2s^2\,2p(^2P°)5d$	$5d\ ^1F°$	3	221137.6	
5f $^3G_3$	$2s^2\,2p(^2P°)5f$	$5f\ ^3G$	3	221227.7	5.0
$^3G_4$			4	221232.7	69.5
$^3G_5$			5	221302.2	
5f $^1G_4$	$2s^2\,2p(^2P°)5f$	$5f\ ^1G$	4	221312.1	
3p′ $^5D_0$	$2s\,2p^2(^4P)3p$	$3p\ ^5D°$	0	224027.1+x	
$^5D_1$			1	224042.9+x	15.8
$^5D_2$			2	224072.3+x	29.4
$^5D_3$			3	224115.4+x	43.1
$^5D_4$			4	224169.3+x	53.9

N II—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3p'\ ^5P_1$	$2s\ 2p^2(^4P)3p$	$3p\ ^5P°$	1	$225987.1+x$	
$^5P_2$			2	$226011.2+x$	24.1
$^5P_3$			3	$226055.2+x$	44.0
$3p'\ ^5S_2$	$2s\ 2p^2(^4P)3p$	$3p\ ^5S°$	2	$230223.0+x$	
	N III $(^2P°_{1/2})$	*Limit*	------	238846.7	
$3d'\ ^5F_1$	$2s\ 2p^2(^4P)3d$	$3d\ ^5F$	1	$243355.5+x$	
$^5F_2$			2	$243371.2+x$	15.7
$^5F_3$			3	$243396.6+x$	25.4
$^5F_4$			4	$243430.2+x$	33.6
$^5F_5$			5	$243470.8+x$	40.6
$3d'\ ^5P_3$	$2s\ 2p^2(^4P)3d$	$3d\ ^5P$	3	$244737.4+x$	
$^5P_2$			2	$244775.9+x$	-38.5
$^5P_1$			1	$244802.0+x$	-26.1
$3d'\ ^5D_0$	$2s\ 2p^2(^4P)3d$	$3d\ ^5D$	0	$245319.8+x$	
$^5D_1$			1	$245323.4+x$	3.6
$^5D_2$			2	$245331.3+x$	7.9
$^5D_3$			3	$245342.9+x$	11.6
$^5D_4$			4	$245356.9+x$	14.0

December 1947.

N II Observed g-Values

Desig.	J	Obs. g	Desig.	J	Obs. g	Desig.	J	Obs. g
$3s\ ^3P°$	1	1.455	$3p\ ^3S$	1	2.015	$3d\ ^1D°$	2	0.986
	2	1.502	$3p\ ^3P$	1	1.530	$3d\ ^3D°$	1	0.494
$3s\ ^1P°$	1	1.051		2	1.497		2	1.114
							3	1.329
$3p\ ^1P$	1	1.005	$3p\ ^1D$	2	1.002	$3d\ ^3P°$	2	1.504
$3p\ ^3D$	1	0.494	$3d\ ^3F°$	3	1.079		1	1.487
	2	1.166		4	1.250	$3d\ ^1P°$	1	1.026
	3	1.330						

N II Observed Terms*

Config. $1s^2+$	Observed Terms
$2s^2\ 2p^2$	$\begin{cases} & 2p^2\ ^3P & \\ 2p^2\ ^1S & & 2p^2\ ^1D \end{cases}$
$2s\ 2p^3$	$\begin{cases} 2p^3\ ^5S° & & \\ 2p^3\ ^3S° & 2p^3\ ^3P° & 2p^3\ ^3D° \\ & 2p^3\ ^1P° & 2p^3\ ^1D° \end{cases}$

	$ns\ (n\geq3)$	$np\ (n\geq3)$	$nd\ (n\geq3)$	$nf\ (n\geq4)$
$2s^2\ 2p(^2P°)nx$	$\begin{cases} 3\text{-}5s\ ^3P° \\ 3\text{-}5s\ ^1P° \end{cases}$	$3,4p\ ^3S \quad 3,4p\ ^3P \quad 3,4p\ ^3D$ $3,4p\ ^1S \quad 3,4p\ ^1P \quad 3,4p\ ^1D$	$3,4d\ ^3P° \quad 3\text{-}5d\ ^3D° \quad 3,4d\ ^3F°$ $3,4d\ ^1P° \quad 3,4d\ ^1D° \quad 3\text{-}5d\ ^1F°$	$4f\ ^3D \quad 4,5f\ ^3F \quad 4,5f\ ^3G$ $4f\ ^1D \quad\ \ 4f\ ^1F \quad 4,5f\ ^1G$
$2s\ 2p^2(^4P)nx$	$\begin{cases} 3s\ ^5P \\ 3s\ ^3P \end{cases}$	$3p\ ^5S° \quad 3p\ ^5P° \quad 3p\ ^5D°$	$3d\ ^5P \quad 3d\ ^5D \quad 3d\ ^5F$	

*For predicted terms in the spectra of the C I isolectronic sequence, see Introduction.

N III

(B I sequence; 5 electrons) Z=7

Ground state $1s^2\ 2s^2\ 2p\ {}^2P^{\circ}_{1/2}$

$2p\ {}^2P^{\circ}_{1/2}$ *382625.5* cm^{-1} I. P. 47.426 volts

All of the terms except those with a 4f-electron, have been taken from Edlén's Monograph. In 1936 Edlén published a revised and extended list of 4f-terms and the corresponding classified lines, including intersystem combinations. The observed correction to his previously published quartet terms -396.4 cm^{-1}, connecting them with the doublet terms has been incorporated into the present list.

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N III

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
$2p\ {}^2P_1$ ${}^2P_2$	$2s^2({}^1S)2p$	$2p\ {}^2P^{\circ}$	½ 1½	0. 0 174. 5	174. 5	$3s'\ {}^4P_1$ ${}^4P_2$ ${}^4P_3$	$2s\ 2p({}^3P^{\circ})3s$	$3s\ {}^4P^{\circ}$	½ 1½ 2½	287535. 6 287598. 1 287713. 9	62. 5 115. 8
$2p'\ {}^4P_1$ ${}^4P_2$ ${}^4P_3$	$2s\ 2p^2$	$2p^2\ {}^4P$	½ 1½ 2½	57192. 1 57252. 0 57333. 2	59. 9 81. 2	$3s'\ {}^2P_1$ ${}^2P_2$	$2s\ 2p({}^3P^{\circ})3s$	$3s\ {}^2P^{\circ}$	½ 1½	297150. 2 297263. 1	112. 9
$2p'\ {}^2D_3$ ${}^2D_2$	$2s\ 2p^2$	$2p^2\ {}^2D$	2½ 1½	101023. 8 101031. 5	$-7. 7$	$4s\ {}^2S_1$	$2s^2({}^1S)4s$	$4s\ {}^2S$	½	301088. 2	
$2p'\ {}^2S_1$	$2s\ 2p^2$	$2p^2\ {}^2S$	½	131003. 5		$3p'\ {}^2P_1$ ${}^2P_2$	$2s\ 2p({}^3P^{\circ})3p$	$3p\ {}^2P$	½ 1½	309132. 6 309185. 8	53. 2
$2p'\ {}^2P_1$ ${}^2P_2$	$2s\ 2p^2$	$2p^2\ {}^2P$	½ 1½	145876. 1 145986. 5	110. 4	$3p'\ {}^4D_1$ ${}^4D_2$ ${}^4D_3$ ${}^4D_4$	$2s\ 2p({}^3P^{\circ})3p$	$3p\ {}^4D$	½ 1½ 2½ 3½	309662. 8 309698. 3 309760. 5 309856. 7	35. 5 62. 2 96. 2
$2p''\ {}^4S_2$	$2p^3$	$2p^3\ {}^4S^{\circ}$	1½	186802. 3		$4p\ {}^2P_1$ ${}^2P_2$	$2s^2({}^1S)4p$	$4p\ {}^2P^{\circ}$	½ 1½	311691. 3 311716. 1	24. 8
$2p''\ {}^2D_3$ ${}^2D_2$	$2p^3$	$2p^3\ {}^2D^{\circ}$	2½ 1½	203072. 2 203088. 9	$-16. 7$	$3p'\ {}^4S_2$	$2s\ 2p({}^3P^{\circ})3p$	$3p\ {}^4S$	1½	314224. 0	
$3s\ {}^2S_1$	$2s^2({}^1S)3s$	$3s\ {}^2S$	½	221302. 4		$3p'\ {}^4P_1$ ${}^4P_2$ ${}^4P_3$	$2s\ 2p({}^3P^{\circ})3p$	$3p\ {}^4P$	½ 1½ 2½	317299. 9 317343. 4 317402. 3	43. 5 58. 9
$2p''\ {}^2P_1$ ${}^2P_2$	$2p^3$	$2p^3\ {}^2P^{\circ}$	½ 1½	230404. 5 230408. 6	4. 1	$4d\ {}^2D_2$ ${}^2D_3$	$2s^2({}^1S)4d$	$4d\ {}^2D$	1½ 2½	317750. 8 317781. 8	31. 0
$3p\ {}^2P_1$ ${}^2P_2$	$2s^2({}^1S)3p$	$3p\ {}^2P^{\circ}$	½ 1½	245665. 7 245701. 7	36. 0		$2s^2({}^1S)4f$	$4f\ {}^2F^{\circ}$	2½ 3½	320287. 5	
$3d\ {}^2D_2$ ${}^2D_3$	$2s^2({}^1S)3d$	$3d\ {}^2D$	1½ 2½	267238. 5 267244. 4	5. 9	$4f\ {}^2F_4$					

N III—Continued

Edlén	Config.	Desig.	J	Level	Interval
3p' ^{2}D$_2$	2s 2p(^{3}P°)3p	3p ^{2}D	1½	320977.4	88.4
^{2}D$_3$			2½	321065.8	
3p' ^{2}S$_1$	2s 2p(^{3}P°)3p	3p ^{2}S	½	327056.8	
3d' ^{4}F$_2$	2s 2p(^{3}P°)3d	3d ^{4}F°	1½	330238.4	35.1
^{4}F$_3$			2½	330273.5	51.8
^{4}F$_4$			3½	330325.3	71.4
^{4}F$_5$			4½	330396.7	
3d' ^{4}D$_1$	2s 2p(^{3}P°)3d	3d ^{4}D°	½	332796.6	13.4
^{4}D$_2$			1½	332810.0	22.0
^{4}D$_3$			2½	332832.0	28.3
^{4}D$_4$			3½	332860.3	
5s ^{2}S$_1$	2s^2(^{1}S)5s	5s ^{2}S	½	333713.1	
3d' ^{2}D$_2$	2s 2p(^{3}P°)3d	3d ^{2}D°	1½	334542.2	26.7
^{2}D$_3$			2½	334568.9	
3d' ^{4}P$_3$	2s 2p(^{3}P°)3d	3d ^{4}P°	2½	336213.4	−54.6
^{4}P$_2$			1½	336268.0	−35.1
^{4}P$_1$			½	336303.1	
3d' ^{2}F$_3$	2s 2p(^{3}P°)3d	3d ^{2}F°	2½	339744.4	111.3
^{2}F$_4$			3½	339855.7	
5d ^{2}D$_2$	2s^2(^{1}S)5d	5d ^{2}D	1½	341946.2	1.7
^{2}D$_3$			2½	341947.9	
3d' ^{2}P$_2$	2s 2p(^{3}P°)3d	3d ^{2}P°	1½	342693.0	−70.7
^{2}P$_1$			½	342763.7	
5f ^{2}F$_4$	2s^2(^{1}S)5f	5f ^{2}F°	2½		
			3½	342752.0	
5g ^{2}G	2s^2(^{1}S)5g	5g ^{2}G	{ 3½ / 4½ }	}343116	
6d ^{2}D$_3$	2s^2(^{1}S)6d	6d ^{2}D	1½		
			2½	354517	
6f ^{2}F$_4$	2s^2(^{1}S)6f	6f ^{2}F°	2½		
			3½	354955.7	
6g ^{2}G	2s^2(^{1}S)6g	6g ^{2}G	{ 3½ / 4½ }	}355214	
4s' ^{4}P$_1$	2s 2p(^{3}P°)4s	4s ^{4}P°	½	368525.6	62.7
^{4}P$_2$			1½	368588.3	116.5
^{4}P$_3$			2½	368704.8	
$\overline{3p'}$ ^{2}D$_2$	2s 2p(^{1}P°)3p	3p' ^{2}D	1½	373342	34
^{2}D$_3$			2½	373376	
4p' ^{2}P$_1$	2s 2p(^{3}P°)4p	4p ^{2}P	½	374747.4	57.9
^{2}P$_2$			1½	374805.3	
4p' ^{4}D$_1$	2s 2p(^{3}P°)4p	4p ^{4}D	½	376756.6	46.7
^{4}D$_2$			1½	376803.3	60.5
^{4}D$_3$			2½	376863.8	89.5
^{4}D$_4$			3½	376953.3	
$\overline{3p'}$ ^{2}P$_1$	2s 2p(^{1}P°)3p	3p' ^{2}P	½	377591	17
^{2}P$_2$			1½	377608	

N III—Continued

Edlén	Config.	Desig.	J	Level	Interval
4p' ^{2}D$_2$	2s 2p(^{3}P°)4p	4p ^{2}D	1½	377883.7	87.1
^{2}D$_3$			2½	377970.8	
4p' ^{4}S$_2$	2s 2p(^{3}P°)4p	4p ^{4}S	1½	378440.5	
4p' ^{4}P$_1$	2s 2p(^{3}P°)4p	4p ^{4}P	½	379307.3	44.8
^{4}P$_2$			1½	379352.1	52.9
^{4}P$_3$			2½	379405.0	
N IV (^{1}S$_0$)		*Limit*	------	382625.5	
	2s 2p(^{3}P°)4d	4d ^{4}F°	1½		
4d' ^{4}F$_3$			2½	384016	49
^{4}F$_4$			3½	384065	74
^{4}F$_5$			4½	384139	
4d' ^{2}D	2s 2p(^{3}P°)4d	4d ^{2}D°	{ 1½ / 2½ }	}385126	
	2s 2p(^{3}P°)4d	4d ^{4}D°	½		
4d' ^{4}D$_2$			1½	385296	27
^{4}D$_3$			2½	385323	29
^{4}D$_4$			3½	385352	
4d' ^{4}P$_3$	2s 2p(^{3}P°)4d	4d ^{4}P°	2½	386246	
			1½		
			½		
4f' ^{2}F$_3$	2s 2p(^{3}P°)4f	4f ^{2}F	2½	386953.4	21
^{2}F$_4$			3½	386974	
	2s 2p(^{3}P°)4f	4f ^{4}F	1½		
4f' ^{4}F$_3$			2½	387000.8	9.5
^{4}F$_4$			3½	387010.3	32.0
^{4}F$_5$			4½	387042.3	
4d' ^{2}F$_3$	2s 2p(^{3}P°)4d	4d ^{2}F°	2½	387728.7	82.8
^{2}F$_4$			3½	387811.5	
4f' ^{4}G$_3$	2s 2p(^{3}P°)4f	4f ^{4}G	2½	388039.2	43.7
^{4}G$_4$			3½	388082.9	51.9
^{4}G$_5$			4½	388134.8	63
^{4}G$_6$			5½	388198	
4f' ^{2}G$_4$	2s 2p(^{3}P°)4f	4f ^{2}G	3½	388190.3	99.7
^{2}G$_5$			4½	388290.0	
4f' ^{4}D$_4$	2s 2p(^{3}P°)4f	4f ^{4}D	3½	388273.4	−37.5
^{4}D$_3$			2½	388310.9	−48.3
^{4}D$_2$			1½	388359.2	−27.4
^{4}D$_1$			½	388386.6	
4f' ^{2}D$_3$	2s 2p(^{3}P°)4f	4f ^{2}D	2½	388376.9	−65.5
^{2}D$_2$			1½	388442.4	
$\overline{3d'}$ ^{2}D$_2$	2s 2p(^{1}P°)3d	3d' ^{2}D°	1½	396574.9	9.9
^{2}D$_3$			2½	396584.8	
	2s 2p(^{3}P°)5d	5d ^{4}D°	½		
			1½		
			2½		
5d' ^{4}D$_4$			3½	409017	

Config. $1s^2+$	Observed Terms			
$2s^2$ (^{1}S)$2p$	$2p$ ^{2}P°			
$2s\,2p^2$	$\{$ $2p^2$ ^{2}S $\quad$ $2p^2$ ^{4}P $\quad$ $2p^2$ ^{2}P $\quad$ $2p^2$ ^{2}D			
$2p^3$	$\{$ $2p^3$ ^{4}S° $\quad$ $2p^3$ ^{2}P° $\quad$ $2p^3$ ^{2}D°			

	ns $(n\geq 3)$	np $(n\geq 3)$	nd $(n\geq 3)$
$2s^2$ (^{1}S)nx	3–5s ^{2}S	3, 4p ^{2}P°	3–6d ^{2}D
$2s\,2p$(^{3}P°)nx	$\{$ 3, 4s ^{4}P° 3s ^{2}P°	3, 4p ^{4}S $\quad$ 3, 4p ^{4}P $\quad$ 3, 4p ^{4}D 3p ^{2}S $\quad$ 3, 4p ^{2}P $\quad$ 3, 4p ^{2}D	3, 4d ^{4}P° $\quad$ 3–5d ^{4}D° $\quad$ 3, 4d ^{4}F° 3d ^{2}P° $\quad$ 3, 4d ^{2}D° $\quad$ 3, 4d ^{2}F°
$2s\,2p$(^{1}P°)nx'		3p' ^{2}P $\qquad$ 3p' ^{2}D	3d' ^{2}D°

	nf $(n\geq 4)$	ng $(n\geq 5)$
$2s^2$ (^{1}S)nx	4–6f ^{2}F°	5, 6g ^{2}G
$2s\,2p$(^{3}P°)nx	$\{$ 4f ^{4}D $\quad$ 4f ^{4}F $\quad$ 4f ^{4}G 4f ^{2}D $\quad$ 4f ^{2}F $\quad$ 4f ^{2}G	

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

N IV

(Be I sequence; 4 electrons) $\hspace{6cm}$ $Z=7$

Ground state $1s^2\,2s^2$ ^{1}S$_0$

$2s^2$ ^{1}S$_0$ 624851 cm^{-1} $\hspace{5cm}$ I. P. 77.450 volts

The terms are from Edlén's papers. The absolute values of the singlet terms are uncertain, since only two members of the ^{1}D-series have been observed. No intersystem combinations have been found. By analogy with N III, Edlén (1936) estimates that $2s^2$ ^{1}S$_0-2p$ ^{3}P$^\circ_1=67200$ cm^{-1}, which gives the absolute value of $2s^2$ ^{1}S$_0$ as 624851 cm^{-1} instead of the earlier value 624499 cm^{-1}. The relative uncertainty x, therefore probably does not exceed ± 300 cm^{-1}.

The terms 4p ^{3}P°, 4f ^{3}F°, 5g ^{3}G, and 3d ^{3}F° are from the 1936 reference. Edlén obtains the 4f ^{3}F° term by assuming that 5g ^{3}G is hydrogen-like (absolute value 70500 cm^{-1}) and adopting Freeman's identification of the 4f ^{3}F°$-$5g ^{3}G group of lines. The listed value of 5g ^{3}G has been adjusted to fit Edlén's adopted value of 4f ^{3}F°.

The estimated value of 3d ^{3}F° is included in the table in brackets.

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B. Edlén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 6, 62 (1934). (T) (C L)
B. Edlén, Zeit. Phys. **98**, 561 (1936). (I P) (C L)

Edlén	Config.	Desig.	J	Level	Interval
2s ¹S₀	2s²	2s² ¹S	0	0	
2p ³P₀	2s(²S)2p	2p ³P°	0	67136.4+x	
³P₁			1	67199.6+x	63.2
³P₂			2	67343.8+x	144.2
2p ¹P₁	2s(²S)2p	2p ¹P°	1	130695	
2p' ³P₀	2p²	2p² ³P	0	175463.5+x	
³P₁			1	175536.7+x	73.2
³P₂			2	175661.5+x	124.8
2p' ¹D₂	2p²	2p² ¹D	2	188885	
2p' ¹S₀	2p²	2p² ¹S	0	235370	
3s ³S₁	2s(²S)3s	3s ³S	1	377206+x	
3s ¹S₀	2s(²S)3s	3s ¹S	0	388858	
3p ¹P₁	2s(²S)3p	3p ¹P°	1	404521	
3p ³P₀	2s(²S)3p	3p ³P°	0	405893.2+x	
³P₁			1	405909.0+x	15.8
³P₂			2	405944.4+x	35.4
3d ³D₁	2s(²S)3d	3d ³D	1	419967.8+x	
³D₂			2	419971.3+x	3.5
³D₃			3	419979.4+x	8.1
3d ¹D₂	2s(²S)3d	3d ¹D	2	429158	
3s' ³P₀	2p(²P°)3s	3s ³P°	0	465223.0+x	
³P₁			1	465300.6+x	77.6
³P₂			2	465463.4+x	162.8
3s' ¹P₁	2p(²P°)3s	3s ¹P°	1	473032	
3p' ¹P₁	2p(²P°)3p	3p ¹P	1	480880	
3p' ³D₂	2p(²P°)3p	3p ³D	1		
³D₃			2	484394 +x	
			3	484525 +x	131
3p' ³S₁	2p(²P°)3p	3p ³S	1	487542 +x	
3p' ³P₁	2p(²P°)3p	3p ³P	0		
³P₂			1	494240 +x	
			2	494338 +x	98
3d' ¹D₂	2p(²P°)3d	3d ¹D°	2	498315	
3p' ¹D₂	2p(²P°)3p	3p ¹D	2	499708	

Edlén	Config.	Desig.	J	Level	Interval
3d' ³F	2p(²P°)3d	3d ³F°	2, 3, 4	[499851] +x	
4p ³P	2s(²S)4p	4p ³P°	0, 1, 2	503625 +x	
3d' ³D₁	2p(²P°)3d	3d ³D°	1	505487 +x	
³D₂			2	505518 +x	31
³D₃			3	505561 +x	43
3d' ¹F₃	2p(²P°)3d	3d ¹F°	3	506292	
4p ¹P₁	2s(²S)4p	4p ¹P°	1	507022	
	2s(²S)4d	4d ³D	1		
			2		
4d ³D₃			3	511384 +x	
3d' ³P₂	2p(²P°)3d	3d ³P°	2	511440 +x	
³P₁			1	511493 +x	-53
			0		
4d ¹D₂	2s(²S)4d	4d ¹D	2	514638	
4f ³F₂	2s(²S)4f	4f ³F°	2	516631 +x	
³F₃			3	516639 +x	8
³F₄			4	516650 +x	11
3d' ¹P₁	2p(²P°)3d	3d ¹P°	1	519414	
4f ¹F₃	2s(²S)4f	4f ¹F°	3	521868	
5p ¹P₁	2s(²S)5p	5p ¹P°	1	550218	
	2s(²S)5d	5d ³D	1		
			2		
5d ³D₃			3	552731 +x	
5g ³G	2s(²S)5g	5g ³G	3, 4, 5	554419 +x	
	2s(²S)6d	6d ³D	1		
			2		
6d ³D₃			3	574940 +x	
4p' ¹D₂	2p(²P°)4p	4p ¹D	2	591043	
4d' ³D₁,₂	2p(²P°)4d	4d ³D°	1, 2	593665 +x	
³D₃			3	593704 +x	39
	N v (²S½)	Limit	------	624851	
	2p(²P°)5d	5d ³D°	1		
			2		
5d' ³D₃			3	634198 +x	

May 1946.

Config. $1s^2+$	Observed Terms				
$2s^2$	$2s^2\ ^1S$				
$2s(^2S)2p$	$\{\quad\quad\quad\ ^2p\ ^3P^\circ$ $\quad\quad\quad\ 2p\ ^1P^\circ$				
$2p^2$	$\{2p^2\ ^1S\quad\quad 2p^2\ ^3P\quad\quad 2p^2\ ^1D$				

	$ns\ (n\geq3)$	$np\ (n\geq3)$			$nd\ (n\geq3)$	$nf\ (n\geq4)$	$ng\ (n\geq5)$
$2s(^2S)nx$	$\{\ 3s\ ^3S$ $\ 3s\ ^1S$	$3,4p\ ^3P^\circ$ $3\text{--}5p\ ^1P^\circ$			$3\text{--}6d\ ^3D$ $3,4d\ ^1D$	$4f\ ^3F^\circ$ $4f\ ^1F^\circ$	$5g\ ^3G$
$2p(^2P^\circ)nx$	$\{\ 3s\ ^3P^\circ$ $\ 3s\ ^1P^\circ$	$3p\ ^3S$	$3p\ ^3P$ $3p\ ^1P$	$3p\ ^3D$ $3,4p\ ^1D$	$3d\ ^3P^\circ\quad 3\text{--}5d\ ^3D^\circ$ $3d\ ^1P^\circ\quad\quad 3d\ ^1D^\circ\quad\quad 3d\ ^1F^\circ$		

*For predicted terms in the spectra of the Be i isoelectronic sequence, see Introduction.

N v

(Li i sequence; 3 electrons) $Z=7$

Ground state $1s^2\ 2s\ ^2S_{\frac{1}{2}}$

$2s\ ^2S_{\frac{1}{2}}$ 789532.9 cm^{-1} I. P. 97.863 volts

Both Edlén and Cady have published analyses of this spectrum. Edlén has recently extended the earlier work and has generously furnished his revised term list in manuscript form. The observed term values in the table are from this unpublished list.

Edlén's extrapolated intervals and the term values for higher series members based on his calculations from the series formula are entered in brackets in the table. These have been taken from his 1933 and 1934 papers.

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B. Edlén, Zeit. Astroph. **7,** 378 (1933). (T) (C L)
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B. Edlén, unpublished material (Sept. 1947). (I P) (T)

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
$2s\ {}^2S_1$	$2s$	$2s\ {}^2S$	½	0.0		6GH	$6g,\ 6h$	$6g\ {}^2G$, etc.	3½ to 5½	[713335]	
$2p\ {}^2P_1$ ${}^2P_2$	$2p$	$2p\ {}^2P°$	½ 1½	80464.9 80723.3	258.4	7S	$7s$	$7s\ {}^2S$	½	[731432]	
$3s\ {}^2S_1$	$3s$	$3s\ {}^2S$	½	456134		7P	$7p$	$7p\ {}^2P°$	½ 1½	732993	
$3p\ {}^2P_1$ ${}^3P_2$	$3p$	$3p\ {}^2P°$	½ 1½	477777.2 477851.4	74.2	7D	$7d$	$7d\ {}^2D$	1½ 2½	[733516]	
$3d\ {}^2D_2$ ${}^2D_3$	$3d$	$3d\ {}^2D$	1½ 2½	484403 484427	[24]	7F	$7f$	$7f\ {}^2F°$	2½ 3½	$[733547]$	
$4s\ {}^2S_1$	$4s$	$4s\ {}^2S$	½	606337		7GHI	$7g$, etc.	$7g\ {}^2G$, etc.	3½ to 6½	[733552]	
$4p\ {}^2P_2$	$4p$	$4p\ {}^2P°$	½ 1½	615150	[32]	8S	$8s$	$8s\ {}^2S$	½	[745260]	
$4d\ {}^2D_3$	$4d$	$4d\ {}^2D$	1½ 2½	617905	[10]	8P	$8p$	$8p\ {}^2P°$	½ 1½	$[746311]$	
	$5s$	$5s\ {}^2S$	½	673882		8D	$8d$	$8d\ {}^2D$	1½ 2½	[746649]	
$5p\ {}^2P_2$	$5p$	$5p\ {}^2P°$	½ 1½	678297	[16]	8F	$8f$	$8f\ {}^2F°$	2½ 3½	$[746670]$	
$5d\ {}^2D_3$	$5d$	$5d\ {}^2D$	1½ 2½	679725	[5]	8GHIK	$8g$, etc.	$8g\ {}^2G$, etc.	3½ to 7½	[746674]	
6S	$6s$	$6s\ {}^2S$	½	[709947]		N vi (${}^1S_0$)	Limit			789532.9	
$6p\ {}^2P$	$6p$	$6p\ {}^2P°$	½ 1½	712464							
$6d\ {}^2D$	$6d$	$6d\ {}^2D$	1½ 2½	713289							
6F	$6f$	$6f\ {}^2F°$	2½ 3½	$[713327]$							

September 1947.

N vi

(He i sequence; 2 electrons) $Z=7$

Ground state $1s^2\ {}^1S_0$

$1s^2\ {}^1S_0$ $4452800 \pm 500\,\mathrm{cm^{-1}}$.   I. P. 551.925 ± 0.062 volts

Tyrén has observed the first three members of the singlet series. They are in the region from 23 A to 28 A. He lists also one intersystem combination—a line at 29.084 A classified as $1s^2\ {}^1S_0 - 2p\ {}^3P_1°$. His unit, $10^3\ \mathrm{cm^{-1}}$, has here been changed to $\mathrm{cm^{-1}}$.

Edlén has generously furnished his unpublished manuscript containing absolute values of the triplet terms extrapolated along the He i isoelectronic sequence. The relative positions of the singlet and triplet terms thus determined confirm the intersystem combination reported by Tyrén. The $2s\ {}^3S - 2p\ {}^3P°$ combination has apparently not been observed, but Edlén regards the extrapolation from the irregular doublet law as very reliable. Brackets are used in the table to indicate extrapolated values not yet confirmed by observation.

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F. Tyrén, Nova Acta Reg. Soc. Sci Uppsala [IV] **12**, No. 1, 24 (1940). (I P) (T) (C L)
B. Edlén, unpublished material (Sept. 1947). (T)

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$1s^2$	$1s^2$ ^{1}S	0	0		$1s\,3p$	$3p$ ^{1}P°	1	*4016390*	
$1s\,2s$	$2s$ ^{3}S	1	[3385890]		$1s\,4p$	$4p$ ^{1}P°	1	*4206810*	
$1s\,2p$	$2p$ ^{3}P°	0	[*3438270*]						
		1	*3438280*	[10]					
		2	[*3438570*]	[290]	N VII (^{2}S$_{\frac{1}{2}}$)	*Limit*	--------	4452800	
$1s\,2p$	$2p$ ^{1}P°	1	*3473790*						

September 1947.

N VII

(H sequence; 1 electron) $Z=7$

Ground state $1s$ ^{2}S$_{\frac{1}{2}}$

$1s$ ^{2}S$_{\frac{1}{2}}$ **5379860** cm^{-1} I. P. 666.83 volts

The first Lyman line has been observed by Tyrén. J. E. Mack has calculated the terms in the table, "using $R_{N^{14}}=109733.004$ and $\Lambda=0.040$. The series limit of N^{15} is higher by 14.0 cm^{-1} than the value given here."

<div align="center">REFERENCES</div>

F. Tyrén, Nova Acta Reg. Soc. Sci. Uppsala [IV] **12,** No. 1, 24 (1940).   (C L)
J. E. Mack, unpublished material (1949).   (I P) (T) (C L)

<div align="center">N VII</div>

Config.	Desig.		J	Level	Interval
$1s$	$1s$ ^{2}S		$\frac{1}{2}$	0	
$2p$		$2p$ ^{2}P°	$\frac{1}{2}$	4034535	⎤ 70
$2s$	$2s$ ^{2}S		$\frac{1}{2}$	4034605	⎥
$2p$		$2p$ ^{2}P°	$1\frac{1}{2}$	4035412	⎦ 876. 9
$3s$, etc.	$3s$ ^{2}S, etc.		$\frac{1}{2}$, etc.	4782035 to 381	
$4s$, etc.	$4s$ ^{2}S, etc.		$\frac{1}{2}$, etc.	5043625 to 789	
	$\infty=$*Limit*		--------	**5379860**	

February 1949.

OXYGEN

O I

8 electrons $\qquad$ Z=8

Ground state $1s^2\,2s^2\,2p^4\,{}^3P_2$

$2p^4\,{}^3P_2$ **109836.7 cm^{-1}** $\qquad$ I. P. 13.614 volts

Edlén has published a detailed analysis of this spectrum in which he has revised and extended the earlier work by others. The terms have all been taken from his paper. For the higher series members not included in his main term table, $ns\,{}^5S°$ and $ns\,{}^3S°$ (n=8 to 11), and $nd\,{}^5D°$ and $nd\,{}^3D°$ (n=8 to 10) the observed values taken from his discussion of the series formulas (p. 15), in which he compares observed and calculated values, are listed below.

Two terms not derived from observed lines are entered in brackets: $11s\,{}^5S°$, which is calculated from the series formula and $2s\,2p^5\,{}^1P°$, which is extrapolated.

Intersystem combinations connect the terms of the singlet, triplet, and quintet systems.

Kiess and Shortley have observed g values for four levels as follows:

Desig.	Obs. g
$3s\,{}^5S°_2$	1.999
$3p\,{}^5P_1$	2.506
${}^5P_2$	1.836
${}^5P_3$	1.666

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K. R. More and C. A. Rieke, Phys. Rev. **50**, 1054 (1936). (Standard wavelengths)
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W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs)
C. C. Kiess and G. Shortley, J. Research Nat. Bur. Std. **42**, 190, RP1961 (1949). (Z E)

O I

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$2s^2\,2p^4$	$2p^4\,{}^3P$	2	0.0	−158.5	$2s^2\,2p^3({}^4S°)4s$	$4s\,{}^3S°$	1	96225.5	
		1	158.5	−68.0	$2s^2\,2p^3({}^4S°)3d$	$3d\,{}^5D°$	4	97420.24	−0.13
		0	226.5				3,2	97420.37	−0.13
$2s^2\,2p^4$	$2p^4\,{}^1D$	2	15867.7				2,1,0	97420.50	
$2s^2\,2p^4$	$2p^4\,{}^1S$	0	33792.4		$2s^2\,2p^3({}^4S°)3d$	$3d\,{}^3D°$	3,2,1	97488.14	
$2s^2\,2p^3({}^4S°)3s$	$3s\,{}^5S°$	2	73767.81		$2s^2\,2p^3({}^4S°)4p$	$4p\,{}^5P$	1	99092.64	0.67
$2s^2\,2p^3({}^4S°)3s$	$3s\,{}^3S°$	1	76794.69				2	99093.31	1.21
$2s^2\,2p^3({}^4S°)3p$	$3p\,{}^5P$	1	86625.35	2.02			3	99094.52	
		2	86627.37	3.67	$2s^2\,2p^3({}^4S°)4p$	$4p\,{}^3P$	2,1,0	99680.4	
		3	86631.04		$2s^2\,2p^3({}^2D°)3s$	$3s'\,{}^3D°$	3	101135.04	−12.17
$2s^2\,2p^3({}^4S°)3p$	$3p\,{}^3P$	2	88630.84	0.54			2	101147.21	−7.89
		1	88630.30	−0.70			1	101155.10	
		0	88631.00		$2s^2\,2p^3({}^4S°)5s$	$5s\,{}^5S°$	2	102116.21	
$2s^2\,2p^3({}^4S°)4s$	$4s\,{}^5S°$	2	95476.43		$2s^2\,2p^3({}^4S°)5s$	$5s\,{}^3S°$	1	102411.65	

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$2s^2\,2p^3(^2D°)3s$	$3s'\ ^1D°$	2	102661.63		$2s^2\,2p^3(^2D°)3p$	$3p'\ ^1D$	2	116630.51	
$2s^2\,2p^3(^4S°)4d$	$4d\ ^5D°$	4	102865.09		$2s^2\,2p^3(^2D°)4s$	$4s'\ ^1D°$	2	122798.7	
		3			$2s^2\,2p^3(^2D°)3d$	$3d'\ ^3P°$	2	123296.6	
		2					1	123355.2	−58.6
		1					0	123386.9	−31.7
		0							
$2s^2\,2p^3(^4S°)4d$	$4d\ ^3D°$	3, 2, 1	102908.14		$2s^2\,2p^3(^2D°)3d$	$3d'\ ^3F°$	4	124213.18	
$2s^2\,2p^3(^4S°)5p$	$5p\ ^3P$	2, 1, 0	103869.4				3		
							2		
$2s^2\,2p^3(^4S°)6s$	$6s\ ^5S°$	2	105019.0		$2s^2\,2p^3(^2D°)3d$	$3d'\ ^1G°$	4	124238.21	
$2s^2\,2p^3(^4S°)6s$	$6s\ ^3S°$	1	105164.90		$2s^2\,2p^3(^2D°)3d$	$3d'\ ^3G°$	5	124239.66	
$2s^2\,2p^3(^4S°)5d$	$5d\ ^5D°$	4 to 0	105385.3				4	124258.37	−18.71
							3	124252.52	5.85
$2s^2\,2p^3(^4S°)5d$	$5d\ ^3D°$	3, 2, 1	105408.58		$2s^2\,2p^3(^2D°)3d$	$3d'\ ^1F°$	3	124326.32	
$2s^2\,2p^3(^4S°)6p$	$6p\ ^3P$	2, 1, 0	105911.3		$2s^2\,2p^3(^2D°)4p$	$4p'\ ^3D$	3	125774.51	
$2s^2\,2p^3(^4S°)7s$	$7s\ ^5S°$	2	106545.1				2	125782.09	−7.58
							1	125787.14	−5.05
$2s^2\,2p^3(^4S°)7s$	$7s\ ^3S°$	1	106627.9		$2s\,2p^5$	$2p^5\ ^3P°$	2	126266.48	
							1	126339.92	−73.44
$2s^2\,2p^3(^4S°)6d$	$6d\ ^5D°$	4 to 0	106751.2				0	126383.44	−43.52
$2s^2\,2p^3(^4S°)6d$	$6d\ ^3D°$	3, 2, 1	106765.8		$2s^2\,2p^3(^2P°)3p$	$3p''\ ^3D$	3	127281.85	
$2s^2\,2p^3(^4S°)8s$	$8s\ ^5S°$	2	107445.4				2	127287.62	−5.77
							1	127290.93	−3.31
$2s^2\,2p^3(^4S°)8s$	$8s\ ^3S°$	1	107497.1		$2s^2\,2p^3(^2P°)3p$	$3p''\ ^1P$	1	127667.85	
$2s^2\,2p^3(^4S°)7d$	$7d\ ^5D°$	4 to 0	107573.1		$2s^2\,2p^3(^2P°)3p$	$3p''\ ^1D$	2	128595.02	
$2s^2\,2p^3(^4S°)7d$	$7d\ ^3D°$	3, 2, 1	107582.7		$2s^2\,2p^3(^2D°)5s$	$5s'\ ^1D°$	2	129134 ±	
$2s^2\,2p^3(^4S°)9s$	$9s\ ^5S°$	2	108021.4		$2s^2\,2p^3(^2D°)4d$	$4d'\ ^3F°$	4	129666.55	
$2s^2\,2p^3(^4S°)9s$	$9s\ ^3S°$	1	108057.6				3		
							2		
$2s^2\,2p^3(^4S°)8d$	$8d\ ^5D°$	4 to 0	108105.7		$2s^2\,2p^3(^2D°)4d$	$4d'\ ^1G°$	4	129679.49	
$2s^2\,2p^3(^4S°)8d$	$8d\ ^3D°$	3, 2, 1	108116.6		$2s^2\,2p^3(^2D°)4d$	$4d'\ ^3G°$	5	129680.14	
$2s^2\,2p^3(^4S°)10s$	$10s\ ^5S°$	2	108412.0				4	129699.16	−19.02
							3	129693.08	6.08
$2s^2\,2p^3(^4S°)10s$	$10s\ ^3S°$	1	108436.1		$2s^2\,2p^3(^2D°)4d$	$4d'\ ^1F°$	3	129736.60	
$2s^2\,2p^3(^4S°)9d$	$9d\ ^5D°$	4 to 0	108470.2		$2s^2\,2p^3(^2D°)4d$	$4d'\ ^3P°$	2	129969.60	
$2s^2\,2p^3(^4S°)9d$	$9d\ ^3D°$	3, 2, 1	108477.8				1	129979.04	−9.44
$2s^2\,2p^3(^4S°)11s$	$11s\ ^5S°$	2	[108688.4]				0	129984.15	−5.11
$2s^2\,2p^3(^4S°)11s$	$11s\ ^3S°$	1	108707.3		$2s^2\,2p^3(^2P°)3p$	$3p''\ ^1S$	0	130943.21	
$2s^2\,2p^3(^4S°)10d$	$10d\ ^5D°$	4 to 0	108731.5		$2s^2\,2p^3(^2D°)6s$	$6s'\ ^1D°$	2	131927 ±	
$2s^2\,2p^3(^4S°)10d$	$10d\ ^3D°$	3, 2, 1	108734.4		$2s^2\,2p^3(^2D°)5d$	$5d'\ ^3F°$	4	132190.7 ±	
O II $(^4S_{1½})$	*Limit*	--------	109836.7				3		
							2		
$2s^2\,2p^3(^2D°)3p$	$3p'\ ^3D$	3	113294.42	−0.13	$2s^2\,2p^3(^2D°)5d$	$5d'\ ^1G°$	4	132197.6 ±	
		2	113294.55	−3.46	$2s^2\,2p^3(^2D°)5d$	$5d'\ ^3G°$	5	132198.1	
		1	113298.01				4	132217.8	−19.7
$2s^2\,2p^3(^2D°)3p$	$3p'\ ^3F$	4	113714.06	−7.00			3		
		3	113721.06	−5.75	$2s^2\,2p^3(^2D°)5d$	$5d'\ ^3P°$	2, 1	132310 ±	
		2	113726.81				0		
$2s^2\,2p^3(^2P°)3s$	$3s''\ ^3P°$	2	113910.20	−10.43	$2s^2\,2p^3(^2D°)7s$	$7s'\ ^1D°$	2	133413 ±	
		1	113920.63	−6.17	$2s^2\,2p^3(^2D°)6d$	$6d'\ ^3P°$	2, 1	133618 ±	
		0	113926.80				0		
$2s^2\,2p^3(^2D°)3p$	$3p'\ ^1F$	3	113995.81						
$2s^2\,2p^3(^2P°)3s$	$3s''\ ^1P°$	1	115918.30		$2s\,2p^5$	$2p^5\ ^1P°$	1	[189837]	

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^4$	$\{$ $2p^4\,{}^1$S $\quad$ $2p^4\,{}^3$P $\quad\quad$ $2p^4\,{}^1$D		
$2s\,2p^5$	$\quad\quad\quad\quad 2p^5\,{}^3$P°		

	ns $(n\geq 3)$	np $(n\geq 3)$	nd $(n\geq 3)$
$2s^2\,2p^3({}^4$S°$)nx$	$\{$ 3–10s ^{5}S° 3–11s ^{3}S°	3, 4p ^{5}P 3–6p ^{3}P	3–10d ^{5}D° 3–10d ^{3}D°
$2s^2\,2p^3({}^2$D°$)nx'$	$\{$ $\quad\quad$ 3s' ^{3}D° $\quad$ 3–7s' ^{1}D°	3, 4p' ^{3}D $\quad$ 3p' ^{3}F $\quad\quad\quad\quad$ 3p' ^{1}D $\quad$ 3p' ^{1}F	3–6d' ^{3}P° $\quad$ 3–5d' ^{3}F° $\quad$ 3–5d' ^{3}G° $\quad\quad\quad\quad$ 3, 4d' ^{1}F° $\quad$ 3–5d' ^{1}G°
$2s^2\,2p^3({}^2$P°$)nx''$	$\{$ 3s'' ^{3}P° 3s'' ^{1}P°	3p'' ^{3}D 3p'' ^{1}S $\quad$ 3p'' ^{1}P $\quad$ 3p'' ^{1}D	

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

O II

(N I sequence; 7 electrons) $\hspace{4cm}$ $Z=8$

Ground state $1s^2\,2s^2\,2p^3\,{}^4$S$^\circ_{1\frac{1}{2}}$

$2p^3\,{}^4$S$^\circ_{1\frac{1}{2}}$ *283550.9* cm^{-1} $\hspace{3cm}$ I. P. 35.146 volts

The terms are from Edlén's publications. He has summarized the earlier work on analysis by others and extended it by his observations in the far ultraviolet.

Edlén states that a number of the $5f$-terms are very uncertain. These are followed by a "?" in the table. His estimated values of three terms from the (^{1}S) limit in O III are given in brackets.

Mihul lists the observed Zeeman effects for 111 lines, which in general agree well with the theoretical patterns for the adopted classifications. From his data a number of g-values could be calculated, but many of the observed patterns are unresolved.

Although the analysis of O II is fairly complete, the measures by different observers are discordant. The term values could be greatly improved by a set of homogeneous observations. A monograph containing all classified lines of this spectrum is also needed.

The doublet and quartet terms are connected by intersystem combinations, but the sextet terms are not so connected with the rest. The relative uncertainty, x, may be a few hundred cm^{-1}.

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Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^4S_2$	$2s^2\ 2p^3$	$2p^3\ ^4S^\circ$	1½	0.0	
$2p\ ^2D_3$ $^2D_2$	$2s^2\ 2p^3$	$2p^3\ ^2D^\circ$	2½ 1½	26808.4 26829.4	−21.0
$2p\ ^2P_2$ $^2P_1$	$2s^2\ 2p^3$	$2p^3\ ^2P^\circ$	1½ ½	40466.9 40468.4	−1.5
$2p'\ ^4P_3$ $^4P_2$ $^4P_1$	$2s\ 2p^4$	$2p^4\ ^4P$	2½ 1½ ½	119837.7 120001.1 120083.5	−163.4 −82.4
$2p'\ ^2D_3$ $^2D_2$	$2s\ 2p^4$	$2p^4\ ^2D$	2½ 1½	165987.7 165996.0	−8.3
$3s\ ^4P_1$ $^4P_2$ $^4P_3$	$2s^2\ 2p^2(^3P)3s$	$3s\ ^4P$	½ 1½ 2½	185235.36 185340.68 185499.20	105.32 158.52
$3s\ ^2P_1$ $^2P_2$	$2s^2\ 2p^2(^3P)3s$	$3s\ ^2P$	½ 1½	188888.38 189068.37	179.99
$2p'\ ^2S_1$	$2s\ 2p^4$	$2p^4\ ^2S$	½	195710.4	
$3p\ ^2S_1$	$2s^2\ 2p^2(^3P)3p$	$3p\ ^2S^\circ$	½	203942.21	
$3p\ ^4D_1$ $^4D_2$ $^4D_3$ $^4D_4$	$2s^2\ 2p^2(^3P)3p$	$3p\ ^4D^\circ$	½ 1½ 2½ 3½	206730.80 206786.34 206877.90 207002.52	55.54 91.56 124.62
$\overline{3s}\ ^2D_3$ $^2D_2$	$2s^2\ 2p^2(^1D)3s$	$3s'\ ^2D$	2½ 1½	206971.3 206972.3	−1.0
$3p\ ^4P_1$ $^4P_2$ $^4P_3$	$2s^2\ 2p^2(^3P)3p$	$3p\ ^4P^\circ$	½ 1½ 2½	208346.17 208392.27 208484.24	46.10 91.97
$3p\ ^2D_2$ $^2D_3$	$2s^2\ 2p^2(^3P)3p$	$3p\ ^2D^\circ$	1½ 2½	211521.98 211712.66	190.68
$3p\ ^4S_2$	$2s^2\ 2p^2(^3P)3p$	$3p\ ^4S^\circ$	1½	212161.94	
$2p'\ ^2P_2$ $^2P_1$	$2s\ 2p^4$	$2p^4\ ^2P$	1½ ½	212593.2 212762.4	−169.2
$3p\ ^2P_1$ $^2P_2$	$2s^2\ 2p^2(^3P)3p$	$3p\ ^2P^\circ$	½ 1½	214169.74 214229.48	59.74
	$2s^2\ 2p^2(^1S)3s$	$3s''\ ^2S$	½	[226851]	
$\overline{3p}\ ^2F_3$ $^2F_4$	$2s^2\ 2p^2(^1D)3p$	$3p'\ ^2F^\circ$	2½ 3½	228723.3 228746.9	23.6
$\overline{3p}\ ^2D_3$ $^2D_2$	$2s^2\ 2p^2(^1D)3p$	$3p'\ ^2D^\circ$	2½ 1½	229946.6 229968.2	−21.6
$3d\ ^4F_2$ $^4F_3$ $^4F_4$ $^4F_5$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^4F$	1½ 2½ 3½ 4½	231296.05 231350.08 231427.99 231530.26	54.03 77.91 102.27
$3d\ ^4P_3$ $^4P_2$ $^4P_1$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^4P$	2½ 1½ ½	232462.83 232536.06 232602.57	−73.23 −66.51
$\overline{3p}\ ^2P_1$ $^2P_2$	$2s^2\ 2p^2(^1D)3p$	$3p'\ ^2P^\circ$	½ 1½	232480.1 232526.7	46.6
$3d\ ^4D_1$ $^4D_2$ $^4D_3$ $^4D_4$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^4D$	½ 1½ 2½ 3½	232711.70 232745.98 232747.51 232753.86	34.28 1.53 6.35
$3d\ ^2F_3$ $^2F_4$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^2F$	2½ 3½	232796.27 232959.26	162.99

Edlén	Config.	Desig.	J	Level	Interval
$3d\ ^2P_2$ $^2P_1$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^2P$	1½ ½	233430.10 233544.09	−113.99
$3d\ ^2D_2$ $^2D_3$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^2D$	1½ 2½	234402.48 234454.45	51.97
$4s\ ^4P_1$ $^4P_2$ $^4P_3$	$2s^2\ 2p^2(^3P)4s$	$4s\ ^4P$	½ 1½ 2½	238626.32 238731.54 238892.96	105.22 161.42
$4s\ ^2P_1$ $^2P_2$	$2s^2\ 2p^2(^3P)4s$	$4s\ ^2P$	½ 1½	240328.75 240516.28	187.53
$3s'\ ^6S_3$	$2s\ 2p^3(^5S^\circ)3s$	$3s'''\ ^6S^\circ$	2½	245395.5 +x	
$4p\ ^4D_1$ $^4D_2$ $^4D_3$ $^4D_4$	$2s^2\ 2p^2(^3P)4p$	$4p\ ^4D^\circ$	½ 1½ 2½ 3½	245767.80 245816.29 245902.85 246028.95	48.49 86.56 126.10
$4p\ ^2D_2$ $^2D_3$	$2s^2\ 2p^2(^3P)4p$	$4p\ ^2D^\circ$	1½ 2½	248009.1 248185.3	176.2
$4p\ ^2P_1$ $^2P_2$	$2s^2\ 2p^2(^3P)4p$	$4p\ ^2P^\circ$	½ 1½	248425.35 248514.23	88.88
	$2s^2\ 2p^2(^1S)3p$	$3p''\ ^2P^\circ$	{ ½ 1½	}[250251]	
$\overline{3d}\ ^2F_4$ $^2F_3$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2F$	3½ 2½	251220.9 251224.1	−3.2
$\overline{3d}\ ^2G_5$ $^2G_4$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2G$	4½ 3½	252607.7 252608.9	−1.2
$\overline{3d}\ ^2D_2$ $^2D_3$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2D$	1½ 2½	253046.23 253048.35	2.12
$\overline{3d}\ ^2P_1$ $^2P_2$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2P$	½ 1½	253789.51 253791.87	2.36
	$2s^2\ 2p^2(^3P)4d$	$4d\ ^4F$	1½ 2½		
$4d\ ^4F_4$ $^4F_5$			3½ 4½	254481.5 254590.7	109.2
$4d\ ^4D_{2,3}$	$2s^2\ 2p^2(^3P)4d$	$4d\ ^4D$	{ ½ 1½ 2½ 3½	}254895.2	
$3s'\ ^4S_2$	$2s\ 2p^3(^5S^\circ)3s$	$3s'''\ ^4S^\circ$	1½	254982.2	
$4d\ ^4P_3$ $^4P_2$ $^4P_1$	$2s^2\ 2p^2(^3P)4d$	$4d\ ^4P$	2½ 1½ ½	255104.6 255140.9 255162.6	−36.3 −21.7
$4d\ ^2P_2$ $^2P_1$	$2s^2\ 2p^2(^3P)4d$	$4d\ ^2P$	1½ ½	255172.5 255281.4	−108.9
$4d\ ^2F_3$ $^2F_4$	$2s^2\ 2p^2(^3P)4d$	$4d\ ^2F$	2½ 3½	255301.3 255465.2	163.9
$\overline{3d}\ ^2S_1$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2S$	½	255622.4	
$4f\ ^2D_3$ $^2D_2$	$2s^2\ 2p^2(^3P)4f$	$4f\ ^2D^\circ$	2½ 1½	255689.6 255812.2	−122.6
$4f\ ^4D_4$ $^4D_3$ $^4D_2$ $^4D_1$	$2s^2\ 2p^2(^3P)4f$	$4f\ ^4D^\circ$	3½ 2½ 1½ ½	255691.4 255813.1 255913 ± 255912.0	−121.7 −100 1

O II—Continued

Eldén	Config.	Desig.	J	Level	Interval
4f ⁴G₃	2s² 2p²(³P)4f	4f ⁴G°	2½	255755.8	
⁴G₄			3½	255759.4	3.6
⁴G₅			4½	255827.6	68.2
⁴G₆			5½	255977.5	149.9
4f ²G₄	2s² 2p²(³P)4f	4f ²G°	3½	255829.4	
²G₅			4½	255983.6	154.2
4d ²D₂	2s² 2p²(³P)4d	4d ²D	1½	255843.1	
²D₃			2½	255897.2	54.1
4f ⁴F₂	2s² 2p²(³P)4f	4f ⁴F°	1½	256083.5	
⁴F₃			2½	256087.6	4.1
⁴F₄			3½	256123.1	35.5
⁴F₅			4½	256136.2	13.1
4f ²F₃	2s² 2p²(³P)4f	4f ²F°	2½	256125.8	
²F₄			3½	256143.3	17.5
5s ⁴P₁	2s² 2p²(³P)5s	5s ⁴P	½	257693.7	
⁴P₂			1½	257797.9	104.2
⁴P₃			2½	257963.8	165.9
5s ²P₁	2s² 2p²(³P)5s	5s ²P	½	258408.6	
²P₂			1½	258601.7	193.1
4̅s̅ ²D₃	2s² 2p²(¹D)4s	4s' ²D	2½	259286.2	
²D₂			1½	259287.0	−0.8
	2s² 2p²(³P)5p	5p ⁴D°	½		
5p ⁴D₂			1½	260959	
⁴D₃			2½	261042	83
⁴D₄			3½	261180	138
	2s² 2p²(³P)5p	5p ⁴P°	½		
5p ⁴P₂			1½	261261.7	
⁴P₃			2½	261354.3	92.6
5p ²D₂	2s² 2p²(³P)5p	5p ²D°	1½	261697.5	
²D₃			2½	261869.4	171.9
	2s² 2p²(³P)5d	5d ⁴D	½		
5d ⁴D₂,₃			{ 1½ 2½ } 3½	}265220.3	
5d ⁴P₃	2s² 2p²(³P)5d	5d ⁴P	2½	265431.5	
⁴P₁,₂			{ 1½ ½ }	}265468.2	−36.7
	2s² 2p²(³P)5d	5d ²F	2½		
5d ²F₄			3½	265578?	
5f ⁴D₄	2s² 2p²(³P)5f	5f ⁴D°	3½	265639	
⁴D₃			2½	265705?	−66
⁴D₂			1½	265762?	−57
⁴D₁			½	265859?	−97
5f ⁴G₃	2s² 2p²(³P)5f	5f ⁴G°	2½	265665?	
⁴G₄			3½	265691	26
⁴G₅			4½	265761	70
⁴G₆			5½	265925	164

O II—Continued

Eldén	Config.	Desig.	J	Level	Interval
5f ²G₄	2s² 2p²(³P)5f	5f ²G°	3½	265763.0	
²G₅			4½	265930.2	167.2
	2s² 2p²(³P)5d	5d ²D	1½		
5d ²D₃			2½	265856	
5f ⁴F₂	2s² 2p²(³P)5f	5f ⁴F°	1½	265928?	
⁴F₃			2½	265961?	33
⁴F₄			3½	265985	24
⁴F₅			4½	265999	14
5f ²F₃	2s² 2p²(³P)5f	5f ²F°	2½	265988?	
²F₄			3½	265999?	11
3p' ⁶P₂	2s 2p³(⁵S°)3p	3p''' ⁶P	1½	267763.39+x	
⁶P₃			2½	267770.85+x	7.46
⁶P₄			3½	267783.40+x	12.55
4̅d̅ ²F₃	2s² 2p²(¹D)4d	4d' ²F	2½	274739.2	
²F₄			3½	274782.4	43.2
4̅d̅ ²D₂₃	2s² 2p²(¹D)4d	4d' ²D	{ 1½ 2½ }	}274920	
4̅d̅ ²P₁₂	2s² 2p²(¹D)4d	4d' ²P	{ ½ 1½ }	}275611?	
4̅f̅ ²G	2s² 2p²(¹D)4f	4f' ²G°	{ 3½ 4½ }	}275841.3	
4̅f̅ ²F	2s² 2p²(¹D)4f	4f' ²F°	{ 2½ 3½ }	}275879.6	
	2s² 2p²(¹S)3d	3d'' ²D	{ 1½ 2½ }	}[275951]	
4̅d̅ ²S₁	2s² 2p²(¹D)4d	4d' ²S	½	275997?	
4̅f̅ ²D	2s² 2p²(¹D)4f	4f' ²D°	{ 1½ 2½ }	}276066.3	
4̅f̅ ²H	2s² 2p²(¹D)4f	4f' ²H°	{ 4½ 5½ }	}276109.1	
4̅f̅ ²P	2s² 2p²(¹D)4f	4f' ²P°	{ ½ 1½ }	}276263.9?	
5̅s̅ ²D₂₃	2s² 2p²(¹D)5s	5s' ²D	{ 1½ 2½ }	}278140	
	O III (³P₀)	*Limit*	------	**283550.9**	
3d' ⁶D₅	2s 2p³(⁵S°)3d	3d''' ⁶D°	4½	291895.90+x	
⁶D₄			3½	291896.78+x	−0.88
⁶D₃			2½	291898.01+x	−1.23
⁶D₂			1½	291899.11+x	−1.10
⁶D₁			½	291899.81+x	−0.70
4s' ⁶S₃	2s 2p³(⁵S°)4s	4s''' ⁶S°	2½	298849.2 +x	

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Config. $1s^2+$	Observed Terms		
$2s^2\,2p^3$	$\{$ $2p^3\,^4S°$ $\quad$ $2p^3\,^2P°$ $\quad$ $2p^3\,^2D°$		
$2s\,2p^4$	$\{$ $2p^4\,^2S$ $\quad$ $2p^4\,^4P$ $\,$ $2p^4\,^2P$ $\quad$ $2p^4\,^2D$		

	$ns\ (n\geq3)$	$np\ (n\geq3)$		
$2s^2\,2p^2(^3P)nx$	$\{$ 3–$5s\,^4P$ $\quad$ 3–$5s\,^2P$	$3p\,^4S°$ $\quad$ $3,5p\,^4P°$ $\quad$ 3–$5p\,^4D°$ $3p\,^2S°$ $\quad$ $3,4p\,^2P°$ $\quad$ 3–$5p\,^2D°$		
$2s^2\,2p^2(^1D)nx'$	3–$5s'\,^2D$	$3p'\,^2P°$ $\quad$ $3p'\,^2D°$ $\quad$ $3p'\,^2F°$		
$2s\,2p^3(^5S°)nx'''$	$\{$ $3,4s'''\,^6S°$ $3s'''\,^4S°$	$3p'''\,^6P$		

	$nd\ (n\geq3)$			$nf\ (n\geq4)$				
$2s^2\,2p^2(^3P)nx$	$\{$ 3–$5d\,^4P$ $\quad$ 3–$5d\,^4D$ $\quad$ $3,4d\,^4F$ $3,4d\,^2P$ $\quad$ 3–$5d\,^2D$ $\quad$ 3–$5d\,^2F$			$4,5f\,^4D°$ $\quad$ $4,5f\,^4F°$ $\quad$ $4,5f\,^4G°$ $4f\,^2D°$ $\quad$ $4,5f\,^2F°$ $\quad$ $4,5f\,^2G°$				
$2s^2\,2p^2(^1D)nx'$	$3,4d'\,^2S$ $\quad$ $3,4d'\,^2P$ $\,$ $3,4d'\,^2D$ $\quad$ $3,4d'\,^2F$ $\quad$ $3d'\,^2G$			$4f'\,^2P°$ $\quad$ $4f'\,^2D°$ $\quad$ $4f'\,^2F°$ $\quad$ $4f'\,^2G°$ $\quad$ $4f'\,^2H°$				
$2s\,2p^3(^5S°)nx'''$	$\{$ $3d'''\,^6D°$							

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

O III

(C I sequence; 6 electrons) $\hfill Z=8$

Ground state $1s^2\,2s^2\,2p^2\ ^3P_0$

$2p^2\ ^3P_0$ **443193.5** cm^{-1} $\hfill$ I. P. 54.934 volts

The terms are from the papers by Edlén. The singlet, triplet and quintet terms are connected by intersystem combinations. Edlén has kindly furnished some unpublished results for inclusion here, namely, that intersystem combinations with quintet terms indicate that his published absolute values of these terms should be decreased by 418 cm^{-1}. This correction has been incorporated into the tabular values of the quintet terms.

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O III
O III

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
2p ³P₀ ³P₁ ³P₂	2s² 2p²	2p² ³P	0 1 2	0. 0 113. 4 306. 8	113. 4 193. 4	3s′ ³P₀ ³P₁ ³P₂	2s 2p²(⁴P)3s	3s ³P	0 1 2	350026. 1 350122. 9 350302. 3	96. 8 179. 4
2p ¹D₂	2s² 2p²	2p² ¹D	2	20271. 0		4s ³P₀ ³P₁ ³P₂	2s² 2p(²P°)4s	4s ³P°	0 1 2	356732 356838 357111	106 273
2p ¹S₀	2s² 2p²	2p² ¹S	0	43183. 5							
2p′ ⁵S₂	2s 2p³	2p³ ⁵S°	2	60312. 1		4s ¹P₁	2s² 2p(²P°)4s	4s ¹P°	1	358667. 4	
2p′ ³D₃ ³D₂ ³D₁	2s 2p³	2p³ ³D°	3 2 1	120025. 4 120052. 6 120058. 5	−27. 2 −5. 9	3p′ ³S₁	2s 2p²(⁴P)3p	3p ³S°	1	363266. 8	
2p′ ³P₂ ³P₁ ³P₀	2s 2p³	2p³ ³P°	2 1 0	142381. 7 142382. 8 142396. 9	−1. 1 −14. 1	3p′ ⁵D₀ ⁵D₁ ⁵D₂ ⁵D₃ ⁵D₄	2s 2p²(⁴P)3p	3p ⁵D°	0 1 2 3 4	365515. 76 365550. 60 365619. 12 365719. 16 365846. 46	34. 84 68. 52 100. 04 127. 30
2p′ ¹D₂	2s 2p³	2p³ ¹D°	2	187049. 4		4p ¹P₁	2s² 2p(²P°)4p	4p ¹P	1	365723. 9	
2p′ ³S₁	2s 2p³	2p³ ³S°	1	197086. 7		4p ³D₁ ³D₂ ³D₂	2s² 2p(²P°)4p	4p ³D	1 2 3	366486. 91 366594. 01 366801. 04	107. 10 207. 03
2p′ ¹P₁	2s 2p³	2p³ ¹P°	1	210458. 5							
3s ³P₀ ³P₁ ³P₂	2s² 2p(²P°)3s	3s ³P°	0 1 2	267257. 29 267375. 65 267632. 59	118. 36 256. 94	4p ³S₁	2s² 2p(²P°)4p	4p ³S	1	367952. 20	
3s ¹P₁	2s² 2p(²P°)3s	3s ¹P°	1	273080. 07		3p′ ⁵P₁ ⁵P₂ ⁵P₃	2s 2p²(⁴P)3p	3p ⁵P°	1 2 3	368526. 37 368583. 63 368684. 75	57. 26 101. 12
2p″ ³P₂ ³P₁ ³P₀	2p⁴	2p⁴ ³P	2 1 0	283758. 9 283976. 6 284073. 3	−217. 7 −96. 7	4p ³P₀ ³P₁ ³P₂	2s² 2p(²P°)4p	4p ³P	0 1 2	370326. 7 370415. 7 370524. 2	89. 0 108. 5
3p ¹P₁	2s² 2p(²P°)3p	3p ¹P	1	290956. 62		4p ¹D₂	2s² 2p(²P°)4p	4p ¹D	2	370900. 6	
3p ³D₁ ³D₂ ³D₃	2s² 2p(²P°)3p	3p ³D	1 2 3	293865. 26 294001. 60 294221. 65	136. 34 220. 05	4p ¹S₀	2s² 2p(²P°)4p	4p ¹S	0	373046. 2	
3p ³S₁	2s² 2p(²P°)3p	3p ³S	1	297557. 50		3p′ ³D₁ ³D₂ ³D₃	2s 2p²(⁴P)3p	3p ³D°	1 2 3	374575 374662. 5 374798. 6	88 136. 1
2p″ ¹D₂	2p⁴	2p⁴ ¹D	2	298289. 4		3p′ ⁵S₂	2s 2p²(⁴P)3p	3p ⁵S°	2	376067. 66	
3p ³P₀ ³P₁ ³P₂	2s² 2p(²P°)3p	3p ³P	0 1 2	300228. 21 300310. 31 300440. 85	82. 10 130. 54	4d ³F₂	2s² 2p(²P°)4d	4d ³F°	2 3 4	377375	
3p ¹D₂	2s² 2p(²P°)3p	3p ¹D	2	306584. 8		4d ¹D₂	2s² 2p(²P°)4d	4d ¹D°	2	377687	
3p ¹S₀	2s² 2p(²P°)3p	3p ¹S	0	313801. 07		3p′ ³P₂ ³P₁ ³P₀	2s 2p²(⁴P)3p	3p ³P°	2 1 0	378408. 5 378420. 9 378438. 1	−12. 4 −17. 2
3d ³F₂ ³F₃ ³F₄	2s² 2p(²P°)3d	3d ³F°	2 3 4	324462. 46 324658. 25 324836. 41	195. 79 178. 16	4d ³D₁ ³D₂ ³D₃	2s² 2p(²P°)4d	4d ³D°	1 2 3	379232 379293 379356	61 63
3d ¹D₂	2s² 2p(²P°)3d	3d ¹D°	2	324734. 22							
3d ³D₁ ³D₂ ³D₃	2s² 2p(²P°)3d	3d ³D°	1 2 3	327227. 94 327277. 18 327350. 90	49. 24 73. 72	4d ³P₂	2s² 2p(²P°)4d	4d ³P°	2 1 0	380706	
3d ³P₂ ³P₁ ³P₀	2s² 2p(²P°)3d	3d ³P°	2 1 0	329467. 98 329581. 98 329643. 43	−114. 00 −61. 45	4d ¹F₃	2s² 2p(²P°)4d	4d ¹F°	3	380782	
3d ¹F₃	2s² 2p(²P°)3d	3d ¹F°	3	331820. 2		4d ¹P₁	2s² 2p(²P°)4d	4d ¹P°	1	381086	
3d ¹P₁	2s² 2p(²P°)3d	3d ¹P°	1	332777. 1			2s² 2p(²P°)5s	5s ³P°	0 1 2	392221	
3s′ ⁵P₁ ⁵P₂ ⁵P₃	2s 2p²(⁴P)3s	3s ⁵P	1 2 3	338565. 87 338690. 34 338851. 50	124. 47 161. 16	5s ³P₂					
						5s ¹P₁	2s² 2p(²P°)5s	5s ¹P°	1	392778	
2p″ ¹S₀	2p⁴	2p⁴ ¹S	0	343302. 6?		3s′ ³D₁ ³D₂ ³D₃	2s 2p²(²D)3s	3s′ ³D	1 2 3	394090 394126 394195	36 69

O III—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3d'\ ^5F_1$	$2s\,2p^2(^4P)3d$	$3d\ ^5F$	1	394516. 45	
$^5F_2$			2	394555. 15	38. 70
$^5F_3$			3	394612. 70	57. 55
$^5F_4$			4	394688. 44	75. 74
$^5F_5$			5	394780. 47	92. 03
$3d'\ ^5D_0$	$2s\,2p^2(^4P)3d$	$3d\ ^5D$	0	398135. 0	
$^5D_1$			1	398131. 4	−3. 6
$^5D_2$			2	398127. 3	−4. 1
$^5D_3$			3	398137. 4	10. 1
D_4			4	398218. 8	81. 4
$3d'\ ^5P_3$	$2s\,2p^2(^4P)3d$	$3d\ ^5P$	3	398474. 3	
$^5P_2$			2	398544. 3	−70. 0
$^5P_1$			1	398582. 8	−38. 5
$3d'\ ^3P_2$	$2s\,2p^2(^4P)3d$	$3d\ ^3P$	2	400354. 8	
$^3P_1$			1	400464. 7	−109. 9
$^3P_0$			0	400518. 4	−53. 7
$3d'\ ^3F_2$	$2s\,2p^2(^4P)3d$	$3d\ ^3F$	2	401379	
$^3F_3$			3	401475. 4	96
$^3F_4$			4	401609. 1	133. 7
$5d\ ^3F_2$	$2s^2\,2p(^2P°)5d$	$5d\ ^3F°$	2	401530	
			3		
			4		
$5d\ ^1D_2$	$2s^2\,2p(^2P°)5d$	$5d\ ^1D°$	2	401787	
	$2s^2\,2p(^2P°)5d$	$5d\ ^3D°$	1		
			2		
$5d\ ^3D_3$			3	402530	
$5d\ ^1F_3$	$2s^2\,2p(^2P°)5d$	$5d\ ^1F°$	3	403374	
$5d\ ^1P_1$	$2s^2\,2p(^2P°)5d$	$5d\ ^1P°$	1	403526	
$3d'\ ^3D_1$	$2s\,2p^2(^4P)3d$	$3d\ ^3D$	1	405805. 1	
$^3D_2$			2	405834. 1	29. 0
$^3D_3$			3	405883. 0	48. 9
$6d\ ^1D_2$	$2s^2\,2p(^2P°)6d$	$6d\ ^1D°$	2	414675	
	$2s^2\,2p(^2P°)6d$	$6d\ ^3D°$	1		
			2		
$6d\ ^3D_3$			3	415181	

O III—Continued

Edlén	Config.	Desig.	J	Level	Interval
$7d\ ^1F_3$	$2s^2\,2p(^2P°)7d$	$7d\ ^1F°$	3	422977	
$\overline{3p'}\ ^1F_3$	$2s\,2p^2(^2D)3p$	$3p'\ ^1F°$	3	424998	
$\overline{3p'}\ ^1D_2$	$2s\,2p^2(^2D)3p$	$3p'\ ^1D°$	2	426338	
$4s'\ ^5P_1$	$2s\,2p^2(^4P)4s$	$4s\ ^5P$	1	428487	
$^5P_2$			2	428606	119
$^5P_3$			3	428769	163
$\overline{3p'}\ ^1P_1$	$2s\,2p^2(^2D)3p$	$3p'\ ^1P°$	1	430025	
$4p'\ ^3S_1$	$2s\,2p^2(^4P)4p$	$4p\ ^3S°$	1	437015. 0	
$4p'\ ^5D_0$	$2s\,2p^2(^4P)4p$	$4p\ ^5D°$	0		
$^5D_1$			1	438241. 0	
$^5D_2$			2	438303. 2	62. 2
$^5D_3$			3	438395. 2	92. 0
$^5D_4$			4	438517. 5	122. 3
$4p'\ ^5P_1$	$2s\,2p^2(^4P)4p$	$4p\ ^5P°$	1	439278. 1	
$^5P_2$			2	439329. 5	51. 4
$^5P_3$			3	439427. 6	98. 1
	$2s\,2p^2(^4P)4p$	$4p\ ^3D°$	1		
			2		
$4p'\ ^3D_3$			3	442710	
O IV $(^2P°_{1/2})$		**Limit**		**443193. 5**	------
$4d'\ ^5P_3$	$2s\,2p^2(^4P)4d$	$4d\ ^5P$	3	450167	
$^5P_2$			2	450237	−70
$^5P_1$			1	450291	−54
$\overline{3d'}\ ^3F$	$2s\,2p^2(^2D)3d$	$3d'\ ^3F$	2, 3, 4	452855	
$\overline{3d'}\ ^3D$	$2s\,2p^2(^2D)3d$	$3d'\ ^3D$	1, 2, 3	454174	
$\overline{3d'}\ ^3P$	$2s\,2p^2(^2D)3d$	$3d'\ ^3P$	0, 1, 2	457634	
$5d'\ ^5P_3$	$2s\,2p^2(^4P)5d$	$5d\ ^5P$		473750	
			1		

December 1947.

O III Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^2$	$\{$ $2p^2\ ^1S$	$2p^2\ ^3P$	$2p^2\ ^1D$
$2s\,2p^3$	$\begin{cases} 2p^3\ ^5S° \\ 2p^3\ ^3S° \end{cases}$ $2p^3\ ^3P°$ $\quad 2p^3\ ^1P°$	$2p^3\ ^3D°$	$2p^3\ ^1D°$
$2p^4$	$2p^4\ ^3P$ $\{$ $2p^4\ ^1S$	$2p^4\ ^1D$	

Config. $1s^2+$	$ns\ (n\geq3)$	$np\ (n\geq3)$	$nd\ (n\geq3)$
$2s^2\,2p(^2P°)nx$	$\begin{cases} 3{-}5s\ ^3P° \\ 3{-}5s\ ^1P° \end{cases}$	$3,4p\ ^3S\quad 3,4p\ ^3P\quad 3,4p\ ^3D$ $3,4p\ ^1S\quad 3,4p\ ^1P\quad 3,4p\ ^1D$	$3,4d\ ^3P°\quad 3{-}6d\ ^3D°\quad 3{-}5d\ ^3F°$ $3{-}5d\ ^1P°\quad 3{-}6d\ ^1D°\quad 3{-}5,7d\ ^1F°$
$2s\,2p^2(^4P)nx$	$\begin{cases} 3,4s\ ^5P \\ 3s\ ^3P \end{cases}$	$3p\ ^5S°\quad 3,4p\ ^5P°\quad 3,4p\ ^5D°$ $3,4p\ ^3S°\quad 3p\ ^3P°\quad 3,4p\ ^3D°$	$3{-}5d\ ^5P\quad 3d\ ^5D\quad 3d\ ^5F$ $3d\ ^3P\quad 3d\ ^3D\quad 3d\ ^3F$
$2s\,2p^2(^2D)nx'$	$\{$ $3s'\ ^3D$	$3p'\ ^1P°\quad 3p'\ ^1D°\quad 3p'\ ^1F°$	$3d'\ ^3P\quad 3d'\ ^3D\quad 3d'\ ^3F$

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

O IV

(B I sequence; 5 electrons) $Z=8$

Ground state $1s^2\,2s^2\,2p\;^2\mathrm{P}^{\circ}_{\frac{1}{2}}$

$2p\;^2\mathrm{P}^{\circ}_{\frac{1}{2}}\;\boldsymbol{624396.5}$ cm^{-1} I. P. 77.394 volts

Most of the terms are from Edlén's Monograph, corrected to agree with his 1935 paper, in which he adds several terms from $2p^2(^1\mathrm{D})$ and relabels his $2p^2(^3\mathrm{P})3s\;^2\mathrm{P}$ term as $2p^2(^1\mathrm{D})3s\;^2\mathrm{D}$. He also lists a combination in the visible, $3s'\;^2\mathrm{P}^{\circ}-3p'\;^2\mathrm{D}$, from which a revised value of $3s'\;^2\mathrm{P}^{\circ}$ has been calculated. A few other additions and corrections kindly communicated by Edlén have been incorporated into the table.

The term $6f\;^2\mathrm{F}^{\circ}$ is from the paper by Whitelaw and Mack.

No intercombinations between the doublet and quartet terms have been observed, but the limits adopted by Edlén are based on well-established series, and the relative positions of the two groups of terms differ by probably only a small constant x.

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B. Edlén, unpublished material (Dec. 1947). (T)

O IV

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
$2p\;^2\mathrm{P}_1$ $^2\mathrm{P}_2$	$2s^2(^1\mathrm{S})2p$	$2p\;^2\mathrm{P}^{\circ}$	½ 1½	0.0 386.5	386.5	$3s'\;^2\mathrm{P}_1$ $^2\mathrm{P}_2$	$2s\,2p(^3\mathrm{P}^{\circ})3s$	$3s\;^2\mathrm{P}^{\circ}$	½ 1½	452808.0 453073.0	265.0
$2p'\;^4\mathrm{P}_1$ $^4\mathrm{P}_2$ $^4\mathrm{P}_3$	$2s\,2p^2$	$2p^2\;^4\mathrm{P}$	½ 1½ 2½	71177.0$+x$ 71308.4$+x$ 71492.9$+x$	131.4 184.5	$3p'\;^2\mathrm{P}_1$ $^2\mathrm{P}_2$	$2s\,2p(^3\mathrm{P}^{\circ})3p$	$3p\;^2\mathrm{P}$	½ 1½	467231.1 467346.5	115.4
$2p'\;^2\mathrm{D}_3$ $^2\mathrm{D}_2$	$2s\,2p^2$	$2p^2\;^2\mathrm{D}$	2½ 1½	126936.3 126950.3	-14.0	$3p'\;^4\mathrm{D}_1$ $^4\mathrm{D}_2$ $^4\mathrm{D}_3$ $^4\mathrm{D}_4$	$2s\,2p(^3\mathrm{P}^{\circ})3p$	$3p\;^4\mathrm{D}$	½ 1½ 2½ 3½	468075.4$+x$ 468154.2$+x$ 468289.7$+x$ 468499.4$+x$	78.8 135.5 209.7
$2p'\;^2\mathrm{S}_1$	$2s\,2p^2$	$2p^2\;^2\mathrm{S}$	½	164366.9		$3p'\;^4\mathrm{S}_2$	$2s\,2p(^3\mathrm{P}^{\circ})3p$	$3p\;^4\mathrm{S}$	1½	474217.8$+x$	
$2p'\;^2\mathrm{P}_1$ $^2\mathrm{P}_2$	$2s\,2p^2$	$2p^2\;^2\mathrm{P}$	½ 1½	180481.3 180724.6	243.3	$3p'\;^4\mathrm{P}_1$ $^4\mathrm{P}_2$ $^4\mathrm{P}_3$	$2s\,2p(^3\mathrm{P}^{\circ})3p$	$3p\;^4\mathrm{P}$	½ 1½ 2½	478587.7$+x$ 478682.2$+x$ 478811.3$+x$	94.5 129.1
$2p''\;^4\mathrm{S}_2$	$2p^3$	$2p^3\;^4\mathrm{S}^{\circ}$	1½	231275.1$+x$		$3p'\;^2\mathrm{D}_2$ $^2\mathrm{D}_3$	$2s\,2p(^3\mathrm{P}^{\circ})3p$	$3p\;^2\mathrm{D}$	1½ 2½	482667.5 482923.1	255.6
$2p''\;^2\mathrm{D}_3$ $^2\mathrm{D}_2$	$2p^3$	$2p^3\;^2\mathrm{D}^{\circ}$	2½ 1½	255156.7 255186.0	-29.3	$4s\;^2\mathrm{S}_1$	$2s^2(^1\mathrm{S})4s$	$4s\;^2\mathrm{S}$	½	485823.1	
$2p''\;^2\mathrm{P}_1$ $^2\mathrm{P}_2$	$2p^3$	$2p^3\;^2\mathrm{P}^{\circ}$	½ 1½	289016.1 289024.0	7.9	$3p'\;^2\mathrm{S}_1$	$2s\,2p(^3\mathrm{P}^{\circ})3p$	$3p\;^2\mathrm{S}$	½	492880	
$3s\;^2\mathrm{S}_1$	$2s^2(^1\mathrm{S})3s$	$3s\;^2\mathrm{S}$	½	357614.8		$3d'\;^4\mathrm{F}_2$ $^4\mathrm{F}_3$ $^4\mathrm{F}_4$ $^4\mathrm{F}_5$	$2s\,2p(^3\mathrm{P}^{\circ})3d$	$3d\;^4\mathrm{F}^{\circ}$	1½ 2½ 3½ 4½	494907.5$+x$ 494986.3$+x$ 495098.7$+x$ 495252.8$+x$	78.8 112.4 154.1
$3p\;^2\mathrm{P}_1$ $^2\mathrm{P}_2$	$2s^2(^1\mathrm{S})3p$	$3p\;^2\mathrm{P}^{\circ}$	½ 1½	390161.1 390248.2	87.1	$3d'\;^4\mathrm{D}_1$ $^4\mathrm{D}_2$ $^4\mathrm{D}_3$ $^4\mathrm{D}_4$	$2s\,2p(^3\mathrm{P}^{\circ})3d$	$3d\;^4\mathrm{D}^{\circ}$	½ 1½ 2½ 3½	499506.4$+x$ 499535.3$+x$ 499582.0$+x$ 499646.6$+x$	28.9 46.7 64.6
$3d\;^2\mathrm{D}_2$ $^2\mathrm{D}_3$	$2s^2(^1\mathrm{S})3d$	$3d\;^2\mathrm{D}$	1½ 2½	419533.5 419550.2	16.7						
$3s'\;^4\mathrm{P}_1$ $^4\mathrm{P}_2$ $^4\mathrm{P}_3$	$2s\,2p(^3\mathrm{P}^{\circ})3s$	$3s\;^4\mathrm{P}^{\circ}$	½ 1½ 2½	438588.5$+x$ 438723.6$+x$ 438970.5$+x$	135.1 246.9						

Edlén	Config.	Desig.	J	Level	Interval
$3d'\ ^2D_2$ $^2D_3$	$2s\,2p(^3P^\circ)3d$	$3d\ ^2D^\circ$	1½ 2½	501511.3 501566.4	55.1
$3d'\ ^4P_3$ $^4P_2$ $^4P_1$	$2s\,2p(^3P^\circ)3d$	$3d\ ^4P^\circ$	2½ 1½ ½	503884.5+x 503947.9+x 504021.7+x	−113.4 −73.8
$4d\ ^2D_2$ $^2D_3$	$2s^2(^1S)4d$	$4d\ ^2D$	1½ 2½	510560 510567	7
$3d'\ ^2F_3$ $^2F_4$	$2s\,2p(^3P^\circ)3d$	$3d\ ^2F^\circ$	2½ 3½	510746.1 510978.5	232.4
$3d'\ ^2P_2$ $^2P_1$	$2s\,2p(^3P^\circ)3d$	$3d\ ^2P^\circ$	1½ ½	514217 514368	−151
$\overline{3s'}\ ^2P_1$ $^2P_2$	$2s\,2p(^1P^\circ)3s$	$3s'\ ^2P^\circ$	½ 1½	518684 518690	6
$5s\ ^2S_1$	$2s^2(^1S)5s$	$5s\ ^2S$	½	539368	
$\overline{3p'}\ ^2D_2$ $^2D_3$	$2s\,2p(^1P^\circ)3p$	$3p'\ ^2D$	1½ 2½	547311 547336	25
$\overline{3p'}\ ^2P_1$ $^2P_2$	$2s\,2p(^1P^\circ)3p$	$3p'\ ^2P$	½ 1½	549792 549855	63
$5d\ ^2D_3$	$2s^2(^1S)5d$	$5d\ ^2D$	1½ 2½	552034	
$5f\ ^2F$	$2s^2(^1S)5f$	$5f\ ^2F^\circ$	{ 2½ 3½ }	}552490	
$\overline{3p'}\ ^2S_1$	$2s\,2p(^1P^\circ)3p$	$3p'\ ^2S$	½	554461	
$4s'\ ^4P_1$ $^4P_2$ $^4P_3$	$2s\,2p(^3P^\circ)4s$	$4s\ ^4P^\circ$	½ 1½ 2½	568638+x 568773+x 569020+x	135 247
$\overline{3d'}\ ^2F_4$	$2s\,2p(^1P^\circ)3d$	$3d'\ ^2F^\circ$	2½ 3½	570791	
$4s'\ ^4P_1$ $^2P_2$	$2s\,2p(^3P^\circ)4s$	$4s\ ^2P^\circ$	½ 1½	573696 573907	211
$6d\ ^2D_3$	$2s^2(^1S)6d$	$6d\ ^2D$	1½ 2½	574373	
$4p'\ ^2P_1$ $^2P_2$	$2s^2\,2p(^3P^\circ)4p$	$4p\ ^2P$	½ 1½	575204 575373	169
$\overline{3d'}\ ^2D_2$ $^2D_3$	$2s\,2p(^1P^\circ)3d$	$3d'\ ^2D^\circ$	1½ 2½	575819 575853	34
$3s''\ ^4P_1$ $^4P_2$ $^4P_3$	$2p^2(^3P)3s$	$3s''\ ^4P$	½ 1½ 2½	576591+x 576735+x 576947+x	144 212
$\overline{3d'}\ ^2P_1$ $^2P_2$	$2s\,2p(^1P^\circ)3d$	$3d'\ ^2P^\circ$	½ 1½	581721 581743	22
$4p'\ ^2D_2$ $^2D_3$	$2s\,2p(^3P^\circ)4p$	$4p\ ^2D$	1½ 2½	584552 584768	216
$7f\ ^2F$	$2s^2(^1S)7f$	$7f\ ^2F^\circ$	{ 2½ 3½ }	}587850	
$4p'\ ^2S$	$2s\,2p(^3P^\circ)4p$	$4p\ ^2S$	½	590071	
$4d'\ ^4D_4$	$2s\,2p(^3P^\circ)4d$	$4d\ ^4D^\circ$	½ 1½ 2½ 3½	591767 +x	
$4d'\ ^4P_3$	$2s\,2p(^3P^\circ)4d$	$4d\ ^4P^\circ$	2½ 1½ ½	592999 +x	
$4d'\ ^2D_2$ $^2D_3$	$2s\,2p(^3P^\circ)4d$	$4d\ ^2D^\circ$	1½ 2½	593627 593708	81
$4f'\ ^2F_3$ $^2F_4$	$2s\,2p(^3P^\circ)4f$	$4f\ ^2F$	2½ 3½	594007 594080	73
$4f'\ ^2D_2$ $^2D_3$	$2s\,2p(^3P^\circ)4f$	$4f\ ^2D$	1½ 2½	594337 594542	205
$4d'\ ^2F_3$ $^2F_4$	$2s\,2p(^3P^\circ)4d$	$4d\ ^2F^\circ$	2½ 3½	596299 596477	178
$3p''\ ^2S_1$	$2p^2(^3P)3p$	$3p''\ ^2S^\circ$	½	597254	
$8f\ ^2F$	$2s^2(^1S)8f$	$8f\ ^2F^\circ$	{ 2½ 3½ }	}597352	
$4d'\ ^2P_2$ $^2P_1$	$2s\,2p(^3P^\circ)4d$	$4d\ ^2P^\circ$	1½ ½	597726 597863	−137
$\overline{3s''}\ ^2D_2$ $^2D_3$	$2p^2(^1D)3s$	$3s'''\ ^2D$	1½ 2½	600092 600106	14
$3p''\ ^4D_4$	$2p^2(^3P)3p$	$3p''\ ^4D^\circ$	½ 1½ 2½ 3½	602977 +x	
$3p''\ ^4P_3$	$2p^2(^3P)3p$	$3p''\ ^4P^\circ$	½ 1½ 2½	606434 +x	
$3p''\ ^2D_3$ $^2D_2$	$2p^2(^3P)3p$	$3p''\ ^2D^\circ$	2½ 1½	615431 615460	−29
$3p''\ ^4S_2$	$2p^2(^3P)3p$	$3p''\ ^4S^\circ$	1½	616588 +x	
O v($^1S_0$)		*Limit*	------	624396.5	
$\overline{3p''}\ ^2F$	$2p^2(^1D)3p$	$3p'''\ ^2F^\circ$	{ 2½ 3½ }	}624882	
$5p'\ ^2P_2$	$2s\,2p(^3P^\circ)5p$	$5p\ ^2P$	½ 1½	628496	
$3d''\ ^2F_4$	$2p^2(^3P)3d$	$3d''\ ^2F$	2½ 3½	630095	
$5p'\ ^2D_2$ $^2D_3$	$2s\,2p(^3P^\circ)5p$	$5p\ ^2D$	1½ 2½	630703 630879	176
$3d''\ ^2D_3$ $^2D_2$	$2p^2(^3P)3d$	$3d''\ ^2D$	2½ 1½	632426 632594	−168
$5d'\ ^4D_4$	$2s\,2p(^3P^\circ)5d$	$5d\ ^4D^\circ$	½ 1½ 2½ 3½	633896 +x	
$5d'\ ^4P_3$	$2s\,2p(^3P^\circ)5d$	$5d\ ^4P^\circ$	2½ 1½ ½	634245.5+x	
$5d'\ ^2F_3$ $^2F_4$	$2s\,2p(^3P^\circ)5d$	$5d\ ^2F^\circ$	2½ 3½	636024 636236	212
$5d'\ ^2P_2$	$2s\,2p(^3P^\circ)5d$	$5d\ ^2P^\circ$	1½ ½	636492?	
$3d''\ ^4P_3$ $^4P_2$ $^4P_1$	$2p^2(^3P)3d$	$3d''\ ^4P$	2½ 1½ ½	636851+x 636950+x 637012+x	−99 −62
$\overline{3d''}\ ^2D$	$2p^2(^1D)3d$	$3d'''\ ^2D$	{ 1½ 2½ }	}646859	

O IV—Continued

Edlén	Config.	Desig.	J	Level	Interval
$\overline{3d''}$ ²F₃ ²F₄	2p²(¹D)3d	3d''' ²F	2½ 3½	651098 651117	19
$\overline{3d''}$ ²P₂ ²P₁	2p²(¹D)3d	3d''' ²P	1½ ½	653328 653411	−83
	2s 2p(³P°)6d	6d ⁴D°	½ 1½ 2½		
6d' ⁴D₄			3½	656328 +x	
$\overline{4p'}$ ²D₃	2s 2p(¹P°)4p	4p' ²D	1½ 2½	656748	
$\overline{3d'''}$ ²S₁	2p²(¹D)3d	3d''' ²S	½	659998	
$\overline{4d'}$ ²D₃	2s 2p(¹P°)4d	4d' ²D°	1½ 2½	668538	
	2s 2p(³P°)7d	7d ⁴D°	½ 1½ 2½		
7d' ⁴D₄			3½	669705 +x	

December 1947.

O IV Observed Terms*

Config. 1s²+	ns (n≥3)	np (n≥3)	nd (n≥3)	nf (n≥4)
2s²(¹S)2p	2p ²P°			
2s 2p²	{2p² ²S 2p² ⁴P 2p² ²P	2p² ²D}		
2p³	{2p³ ⁴S° 2p³ ²P°	2p³ ²D°}		
2s²(¹S)nx	3–5s ²S	3p ²P°	3–6d ²D	5, 7, 8f ²F°
2s 2p(³P°)nx	3, 4s ⁴P° 3, 4s ²P°	3p ⁴S 3, 4p ²S 3p ⁴P 3–5p ²P 3p ⁴D 3–5p ²D	3–5d ⁴P° 3–5d ²P° 3–7d ⁴D° 3, 4d ²D° 3d ⁴F° 3–5d ²F°	4f ²D
2s 2p(¹P°)nx'	3s' ²P°	3p' ²S 3p' ²P 3, 4p' ²D	3d' ²P° 3d' ²D° 3d' ²D 3d' ²F°	4f ²D
2p²(³P)nx''	3s'' ⁴P	3p'' ⁴S° 3p'' ²S° 3p'' ⁴P° 3p'' ⁴D° 3p'' ²D°	3d'' ⁴P 3d'' ²D 3d'' ²F	3d'' ²F
2p²(¹D)nx'''	3s''' ²D	3p''' ²F°	3d''' ²S 3d''' ²P 3d''' ²D 3d''' ²F	3d''' ²F

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

O v

(Be I sequence; 4 electrons)   Z=8

Ground state $1s^2\,2s^2\,{}^1S_0$

$2s^2\,{}^1S_0$ **918702** cm^{-1} I. P. 113.873 volts

Edlén has revised and extended his published analysis and has generously furnished a manuscript copy of his complete term list in advance of publication, for inclusion here. He states that no intersystem combinations have been observed and that the relative uncertainty x in the position of the triplet terms with respect to the singlets may be ± 100 cm^{-1}.

In the published papers Edlén has used a prime to designate the terms from the ${}^2P^\circ$ limit in O vi.

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O v

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$2s^2$	$2s^2\ {}^1S$	0	0		$2p({}^2P^\circ)3p$	$3p\ {}^3S$	1	684124 $+x$	
$2s({}^2S)2p$	$2p\ {}^3P^\circ$	0	82121.2$+x$	136.7	$2p({}^2P^\circ)3p$	$3p\ {}^3P$	0	689585.6$+x$	114.0
		1	82257.9$+x$	306.2			1	689699.6$+x$	190.7
		2	82564.1$+x$				2	689890.3$+x$	
$2s({}^2S)2p$	$2p\ {}^1P^\circ$	1	158798		$2p({}^2P^\circ)3d$	$3d\ {}^1D^\circ$	2	694646	
$2p^2$	$2p^2\ {}^3P$	0	213641.7$+x$	155.7	$2p({}^2P^\circ)3p$	$3p\ {}^1D$	2	697170	
		1	213797.4$+x$	268.8	$2p({}^2P^\circ)3d$	$3d\ {}^3D^\circ$	1	704360 $+x$	64
		2	214066.2$+x$				2	704424 $+x$	103
$2p^2$	$2p^2\ {}^1D$	2	231722				3	704527 $+x$	
$2p^2$	$2p^2\ {}^1S$	0	287909		$2p({}^2P^\circ)3p$	$3p\ {}^1S$	0	707630	
$2s({}^2S)3s$	$3s\ {}^3S$	1	547150.0$+x$		$2p({}^2P^\circ)3d$	$3d\ {}^3P^\circ$	2	708154 $+x$	-142
$2s({}^2S)3s$	$3s\ {}^1S$	0	561278				1	708296 $+x$	-83
$2s({}^2S)3p$	$3p\ {}^1P^\circ$	1	580826				0	708379 $+x$	
$2s({}^2S)3p$	$3p\ {}^3P^\circ$	0	582983.6$+x$	36.3	$2p({}^2P^\circ)3d$	$3d\ {}^1F^\circ$	3	712967	
		1	583019.9$+x$	77.3	$2p({}^2P^\circ)3d$	$3d\ {}^1P^\circ$	1	719277	
		2	583097.2$+x$		$2s({}^2S)4s$	$4s\ {}^3S$	1	722666 $+x$	
$2s({}^2S)3d$	$3d\ {}^3D$	1	600925.5$+x$	10.8	$2s({}^2S)4s$	$4s\ {}^1S$	0	731667	
		2	600936.3$+x$	19.8	$2s({}^2S)4p$	$4p\ {}^3P^\circ$	0		
		3	600956.1$+x$				1	736108 $+x$	18
$2s({}^2S)3d$	$3d\ {}^1D$	2	612617				2	736126 $+x$	
$2p({}^2P^\circ)3s$	$3s\ {}^3P^\circ$	0	653099.7$+x$	162.5	$2s({}^2S)4p$	$4p\ {}^1P^\circ$	1	737883	
		1	653262.2$+x$	342.8	$2s({}^2S)4d$	$4d\ {}^3D$	1	742401 $+x$	6
		2	653605.0$+x$				2	742407 $+x$	14
$2p({}^2P^\circ)3s$	$3s\ {}^1P^\circ$	1	664486				3	742421 $+x$	
$2p({}^2P^\circ)3p$	$3p\ {}^1P$	1	672695		$2s({}^2S)4d$	$4d\ {}^1D$	2	746280	
$2p({}^2P^\circ)3p$	$3p\ {}^3D$	1	677333 $+x$	199	$2s({}^2S)4f$	$4f\ {}^1F^\circ$	3	749857	
		2	677532 $+x$	315	$2s({}^2S)5s$	$5s\ {}^3S$	1	796263 $+x$	
		3	677847 $+x$						

O v—Continued | O v—Continued

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
2s(²S)5p	5p ¹P°	1	*802452*		2s(²S)7p	7p ¹P°	1	*860874*	
2s(²S)5d	5d ³D	1 2 3	 806625 +x		2s(²S)7d	7d ³D	1 2 3	 861975 +x	
2s(²S)5d	5d ¹D	2	808351		2s(²S)7d	7d ¹D	2	862419	
2p(²P°)4s	4s ¹P°	1	*824280*		2s(²S)8p	8p ¹P°	1	*874447*	
2p(²P°)4p	4p ¹P	1	829588		2s(²S)8d	8d ³D	1 2 3	 875365 +x	
2p(²P°)4p	4p ³D	1 2 3	831047 +x 831213 +x 831504 +x	166 291	2p(²P°)5p	5p ¹P	1	898580	
2p(²P°)4p	4p ³S	1	832251 +x		2p(²P°)5p	5p ³D	1 2 3	 899671 +x	
2p(²P°)4p	4p ³P	0 1 2	 835151 +x 835321 +x	170	2p(²P°)5p	5p ³P	0 1 2	 901344 +x	
2p(²P°)4d	4d ¹D°	2	*837834*		2p(²P°)5p	5p ¹D	2	902442	
2p(²P°)4p	4p ¹D	2	837864		2p(²P°)5d	5d ¹D°	2	*902592*	
2s(²S)6p	6p ¹P°	1	*839616*		2p(²P°)5d	5d ³D°	1 2 3	 904497 +x	
2s(²S)6f	6f ¹F°	3	*840832*		2p(²P°)5d	5d ¹F°	3	*906404*	
2s(²S)6d	6d ³D	1 2 3	 841220 +x		O vi (²S½)	Limit	---------	**918702**	
2p(²P°)4d	4d ³D°	1 2 3	*841280* +x *841374* +x *841497* +x	94 123	2p(²P°)6p	6p ¹P	1	935093	
2s(²S)6d	6d ¹D	2	842105		2p(²P°)6p	6p ³D	1 2 3	 935945 +x	
2p(²P°)4d	4d ³P°	2 1 0	*843290* +x *843397* +x *843449* +x	−107 −52	2p(²P°)6p	6p ³P	0 1 2	 936805 +x	
2p(²P°)4d	4d ¹F°	3	*847129*		2p(²P°)6p	6p ¹D	2	937341	
2p(²P°)4d	4d ¹P°	1	*847465*						

December 1947.

O v Observed Terms*

Config. 1s²+	Observed Terms			
2s²	2s² ¹S			
2s(²S)2p	{ 2p ³P° 2p ¹P°			
2p²	{ 2p² ¹S	2p² °P 2p² ¹D		

	ns (n≥3)	np (n≥3)	nd (n≥3)	nf (n≥4)
2s(²S)nx	3–5s ³S 3, 4s ¹S	3, 4p ³P° 3–8p ¹P°	3–8d ³D 3–7d ¹D	4, 6f ¹F°
2p(²P°)nx	3s ³P° 3, 4s ¹P°	3, 4p ³S 3–6p ³P 3–6p ³D 3p ¹S 3–6p ¹P 3–6p ¹D	3, 4d ³P° 3–5d ³D° 3, 4d ¹P° 3–5d ¹D° 3–5d ¹F°	

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

O VI

(Li I sequence; 3 electrons)   Z=8

Ground state $1s^2\,2s\ ^2S_{\frac{1}{2}}$

$2s\ ^2S_{\frac{1}{2}}$ **1113999.5** cm^{-1} I. P. 138.080 volts

This spectrum has been analyzed by Edlén. The observed term values have all been taken from a manuscript generously furnished by him in advance of publication. He remarks that the $np\ ^2P°$ and $nd\ ^2D$ series have been observed in the vacuum spark further than given in the table. For series members beyond $n=6$ he states that the term values calculated from a Ritz formula are probably to be preferred.

In the table, extrapolated intervals and calculated term values are entered in brackets. They have been taken from the 1933 and 1934 references below, as have also the entries in column one.

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O VI

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
$2s\ ^2S_1$	$2s$	$2s\ ^2S$	½	0. 0		6 F	$6f$	$6f\ ^2F°$	{ 2½ 3½ }	[1004265]	
$2p\ ^2P_1$ $^2P_2$	$2p$	$2p\ ^2P°$	½ 1½	96375. 0 96907. 5	532. 5	6 GH	$6g,\ 6h$	$6g\ ^2G$, etc.	{ 3½ to 5½ }	[1004276]	
$3s\ ^2S_1$	$3s$	$3s\ ^2S$	½	640039. 8		7 S	$7s$	$7s\ ^2S$	½	1030780	
$3p\ ^2P_1$ $^2P_2$	$3p$	$3p\ ^2P°$	½ 1½	666113. 2 666269. 8	156. 6	7 P	$7p$	$7p\ ^2P°$	{ ½ 1½ }	1032630	
$3d\ ^2D_2$ $^2D_3$	$3d$	$3d\ ^2D$	1½ 2½	674625. 7 674676. 8	51. 1	7 D	$7d$	$7d\ ^2D$	{ 1½ 2½ }	1033324	
$4s\ ^2S_1$	$4s$	$4s\ ^2S$	½	852696		7 F	$7f$	$7f\ ^2F°$	{ 2½ 3½ }	[1033382]	
$4p\ ^2P_1$ $^2P_2$	$4p$	$4p\ ^2P°$	½ 1½	863333. 8 863397. 7	63. 9	7 GHI	$7g$, etc.	$7g\ ^2G$, etc.	{ 3½ to 6½ }	[1033389]	
$4d\ ^2D_2$ $^2D_3$	$4d$	$4d\ ^2D$	1½ 2½	866880. 1 866901. 5	21. 4	8 S	$8s$	$8s\ ^2S$	½	[1050543]	
$4f\ ^2F_3$ $^2F_4$	$4f$	$4f\ ^2F°$	2½ 3½	867077. 7 867087. 5	9. 8	8 P	$8p$	$8p\ ^2P°$	{ ½ 1½ }	1051724	
	$5s$	$5s\ ^2S$	½	948690		8 F	$8f$	$8f\ ^2F°$	{ 2½ 3½ }	[1052280]	
$5p\ ^2P_2$	$5p$	$5p\ ^2P°$	{ ½ 1½ }	954080	[33]	8 GHIK	$8g$, etc.	$8g\ ^2G$, etc.	{ 3½ to 7½ }	[1052285]	
$5d\ ^2D_3$	$5d$	$5d\ ^2D$	{ 1½ 2½ }	955856	[11]	8 D	$8d$	$8d\ ^2D$	{ 1½ 2½ }	1052296	
6 S	$6s$	$6s\ ^2S$	½	1000080							
6 P	$6p$	$6p\ ^2P°$	{ ½ 1½ }	1003130		O VII ($^1S_0$)		*Limit*		1113999. 5	
$6d\ ^2D_3$	$6d$	$6d\ ^2D$	{ 1½ 2½ }	1004178							

September 1947.

O VII

(He I sequence; 2 electrons) $Z=8$

Ground State $1s^2$ $^1S_0$

$1s^2$ $^1S_0$ **5963000** $\pm$ **600** cm^{-1} I. P. 739.114 $\pm$0.074 volts

Five singlet lines have been observed by Tyrén in the interval 17 A to 21 A. He has also observed one intersystem combination—a line at 21.804 A classified as $1s^2$ $^1S_0$—$2p$ $^3P_1^\circ$. His unit 10^3 cm^{-1} has here been changed to cm^{-1}.

The triplet terms are from Edlén, who has kindly furnished them in advance of publication. He remarks that the extrapolated absolute term values of the triplets relative to those of the singlets confirm the intersystem combination reported by Tyrén. The $2s$ ^3S—$2p$ $^3P^\circ$ combination has apparently not been observed, but Edlén regards the extrapolation from the irregular doublet law as very reliable. Brackets are used in the table to indicate extrapolated values not yet confirmed by observation.

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B. Edlén, unpublished material (Sept. 1947). (T)

O VII   **O VII**

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$1s^2$	$1s^2$ ^1S	0	0		$1s\,3p$	$3p$ $^1P^\circ$	1	5368550	
$1s\,2s$	$2s$ ^3S	1	4525340		$1s\,4p$	$4p$ $^1P^\circ$	1	5628100	
$1s\,2p$	$2p$ $^3P^\circ$	0	[4586170]	[60]	$1s\,5p$	$5p$ $^1P^\circ$	1	5748450	
		1	4586230	[550]	$1s\,6p$	$6p$ $^1P^\circ$	1	5813950	
		2	[4586780]						
$1s\,2p$	$2p$ $^1P^\circ$	1	4629200		O VIII ($^2S_{1/2}$)	*Limit*	--------	5963000	
$1s\,3p$	$3p$ $^3P^\circ$	0, 1, 2	5356380						
$1s\,3d$	$3d$ ^3D	3, 2, 1	5364990						

September 1947.

O VIII

(H sequence; 1 electron) $Z=8$

Ground state $1s$ $^2S_{1/2}$

$1s$ $^2S_{1/2}$ **7027970** cm^{-1} I. P. 871.12 volts

Tyrén has observed the first Lyman line. J. E. Mack has calculated the terms in the table, "using $R_0{}^{16}=109733.539$, and $\Lambda=0.040$. The last digit is arbitrary, since the extrapolated $1s$-shift is 957 cm^{-1}. The series limits of O^{17} and O^{18} are higher than that for O^{16} by 14.3 and 25.8 cm^{-1}, respectively."

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J. E. Mack, unpublished material (1949). (I P) (T) (C L)

O VIII   **O VIII**

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$1s$	$1s$ ^2S	$\frac{1}{2}$	0		$3s$, etc.	$3s$ ^2S, etc.	$\frac{1}{2}$, etc.	6246978 to 7569	
$2p$	$2s$ ^2S, $2p$ $^2P^\circ$	$\frac{1}{2}$	5270363	120					
$2s$		$\frac{1}{2}$	5270483	1496					
$2p$	$2p$ $^2P^\circ$	$1\frac{1}{2}$	5271859		$\infty=$ *Limit*	--------	7027970		

February 1949.

FLUORINE

F I

9 electrons $Z=9$

Ground state $1s^2\, 2s^2\, 2p^5\, {}^2P^\circ_{1\frac{1}{2}}$

$2p^5\, {}^2P^\circ_{1\frac{1}{2}}$ *140553.5* cm^{-1} I. P. 17.42 volts

This spectrum is incompletely analyzed, but the terms from the ^{3}P limit in F II are fairly well established.   The terms listed have been taken from Edlén's later paper, supplemented by levels from further recent analysis by Lidén.   The new levels have been generously furnished in manuscript form by Edlén, for inclusion here.

Intersystem combinations have been observed, connecting the doublet and quartet terms.

Edlén remarks that it is impossible to assign term designations to the levels labeled $3d$ X and $4d$ X, because of the departure from *LS*-coupling.   He also states that the terms from ^{1}D in F II need further confirmation.   They are connected with the rest by only two ultraviolet lines, those observed by Bowen at 806.92 A and 809.60 A.

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F I   F I

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
$2p\ {}^2P_2$ $^2P_1$	$2s^2\ 2p^5$	$2p^5\ {}^2P^\circ$	$1\frac{1}{2}$ $\frac{1}{2}$	*0. 0* *404.0*	$-404.\,0$	$3p\ {}^2D_3$ $^2D_2$	$2s\ 2p^4(^3P)3p$	$3p\ {}^2D^\circ$	$2\frac{1}{2}$ $1\frac{1}{2}$	*117623. 73* *117873. 75*	$-250.\,02$
$3s\ {}^4P_3$ $^4P_2$ $^4P_1$	$2s^2\ 2p^4(^3P)3s$	$3s\ {}^4P$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	102406. 50 102681. 24 102841. 20	$-274.\,74$ $-159.\,96$	$3p\ {}^2S_1$	$2s^2\ 2p^4(^3P)3p$	$3p\ {}^2S^\circ$	$\frac{1}{2}$	*118406. 09*	
						$3p\ {}^4S_2$	$2s^2\ 2p^4(^3P)3p$	$3p\ {}^4S^\circ$	$1\frac{1}{2}$	*118428. 62*	
$3s\ {}^2P_2$ $^2P_1$	$2s^2\ 2p^4(^3P)3s$	$3s\ {}^2P$	$1\frac{1}{2}$ $\frac{1}{2}$	104731. 86 105057. 10	$-325.\,24$	$3p\ {}^2P_2$ $^2P_1$	$2s^2\ 2p^4(^3P)3p$	$3p\ {}^2P^\circ$	$1\frac{1}{2}$ $\frac{1}{2}$	*118937. 61* *119082. 63*	$-145.\,02$
$3p\ {}^4P_3$ $^4P_2$ $^4P_1$	$2s^2\ 2p^4(^3P)3p$	$3p\ {}^4P^\circ$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	*115918. 70* *116041. 69* *116144. 39*	$-122.\,99$ $-102.\,70$	$\overline{3s}\ {}^2D_3$ $^2D_2$	$2s^2\ 2p^4(^1D)3s$	$3s'\ {}^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	123925. 50 123926. 56	$-1.\,06$
$3p\ {}^4D_4$ $^4D_3$ $^4D_2$ $^4D_1$	$2s^2\ 2p^4(^3P)3p$	$3p\ {}^4D^\circ$	$3\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	*116988. 21* *117164. 83* *117309. 37* *117392. 77*	$-176.\,62$ $-144.\,54$ $-83.\,40$	$3d\ {}^4D_4$ $^4D_3$ $^4D_2$ $^4D_1$	$2s^2\ 2p^4(^3P)3d$	$3d\ {}^4D$	$3\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	128064. 90 128088. 63 128123. 51 128185. 80	$-23.\,73$ $-34.\,88$ $-62.\,29$

F I—Continued F I—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3d$ X$_8$	$2s^2\,2p^4(^3P)3d$	$3d$ Z$_4$		128141. 27	
$3d$ ^{4}F$_5$	$2s^2\,2p^4(^3P)3d$	$3d$ ^{4}F	4½	128219. 92	−295. 63
^{4}F$_4$			3½	128515. 55	−10. 60
^{4}F$_3$			2½	128526. 15	−86. 58
^{4}F$_2$			1½	128612. 73	
$3d$ X$_7$	$2s^2\,2p^4(^3P)3d$	$3d$ Z$_2$		128220. 65	
$3d$ X$_6$	$2s^2\,2p^4(^3P)3d$	$3d$ Z$_3$		128221. 16	
$3d$ X$_5$	$2s^2\,2p^4(^3P)3d$	$3d$ Y$_3$		128339. 53	
$3d$ X$_4$	$2s^2\,2p^4(^3P)3d$	$3d$ Y$_2$	1½	128524. 09	
$3d$ X$_3$	$2s^2\,2p^4(^3P)3d$	$3d$ Y$_1$		128606. 88	
$3d$ X$_2$	$2s^2\,2p^4(^3P)3d$	$3d$ X$_2$		128698. 68	
$3d$ X$_1$	$2s^2\,2p^4(^3P)3d$	$3d$ X$_1$		128713. 12	
	$2s^2\,2p^4(^3P)5s$	$5s$ ^{4}P	2½	132596. 26	−149. 51
			1½	132745. 77	−264. 19
			½	133009. 96	
	$2s^2\,2p^4(^3P)5s$	$5s$ ^{2}P	1½	132999. 16	−224. 94
			½	133224. 10	
	$2s^2\,2p^4(^3P)4d$	$4d$ ^{4}D	3½	133545. 27	−12. 87
			2½	133558. 14	−20. 01
			1½	133578. 15	−35. 95
			½	133614. 10	
	$2s^2\,2p^4(^3P)4d$	$4d$ Z$_1$		133584. 35	

Edlén	Config.	Desig.	J	Level	Interval
	$2s^2\,2p^4(^3P)4d$	$4d$ ^{4}F	4½	133606. 39	−317. 44
			3½	133923. 83	−8. 73
			2½	133932. 56	−39. 50
			1½	133972. 06	
	$2s^2\,2p^4(^3P)4d$	$4d$ Z$_3$		133607. 33	
	$2s^2\,2p^4(^3P)4d$	$4d$ Z$_2$		133624. 61	
	$2s^2\,2p^4(^3P)4d$	$4d$ Z$_1$		133644. 4	
	$2s^2\,2p^4(^3P)4d$	$4d$ Y$_3$		133911. 08	
	$2s^2\,2p^4(^3P)4d$	$4d$ Y$_2$		133920. 20	
	$2s^2\,2p^4(^3P)4d$	$4d$ Y$_1$		133966. 47	
	$2s^2\,2p^4(^3P)4d$	$4d$ X$_2$		134085. 53	
	$2s^2\,2p^4(^3P)4d$	$4d$ X$_1$		134092. 03	
$\overline{3p}$ ^{2}F$_3$ ^{2}F$_4$	$2s^2\,2p^4(^1D)3p$	$3p'$ ^{2}F°	2½ / 3½	*137594. 63* / *137603. 44*	8. 81
$\overline{3p}$ ^{2}D$_2$ ^{2}D$_3$	$2s^2\,2p^4(^1D)3p$	$3p'$ ^{2}D°	1½ / 2½	*138700. 15* / *138708. 01*	7. 86
	F II (^{3}P$_2$)	*Limit*	------	*140553. 5*	
$2p'$ ^{2}S$_1$	$2s\,2p^6$	$2p^6$ ^{2}S	½	[168554]	

December 1947.

F I Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^5$	$2p^5$ ^{2}P°		
	ns $(n\ge 3)$	np $(n\ge 3)$	nd $(n\ge 3)$
$2s^2\,2p^4(^3P)nx$	{ 3, 5s ^{4}P { 3, 5s ^{2}P	$3p$ ^{4}S° $3p$ ^{4}P° $3p$ ^{4}D° $3p$ ^{2}S° $3p$ ^{2}P° $3p$ ^{2}D°	3, 4d ^{4}D 3, 4d ^{4}F
$2s^2\,2p^4(^1D)nx'$	3s' ^{2}D	$3p'$ ^{2}D° $3p'$ ^{2}F°	

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

F II

(O I sequence; 8 electrons) $Z=9$

Ground state $1s^2\ 2s^2\ 2p^4\ {}^3P_2$

$2p^4\ {}^3P_2$ 282190.2 cm^{-1} I. P. 34.98 volts

Bowen, Dingle, and Edlén have all contributed to the analysis of this spectrum. The singlet and triplet terms are taken from Edlén, who has revised and extended the earlier work. The quintet terms, except $5f\ {}^5F$, are from Dingle's paper. The term $5f\ {}^5F$ derived by Edlén agrees well with the $4f\ {}^5F$ term and Dingle's series limit.

The singlet and triplet terms are connected by intersystem combinations. The relative position of the quintets is determined by the series with the uncertainty x probably not exceeding 200 cm^{-1}.

Edlén lists a number of combinations that probably involve $2s^2\ 2p^3(^2D°)4f$ terms at about $288600\pm$ cm^{-1} above the ground state.

In a private communication Edlén has stated that his term published as $\overline{\overline{3d}}\ {}^3D$ should have the designation $\overline{\overline{4s}}\ {}^3P$. He has also revised his published value of $3d'\ {}^1S°$.

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F II   F II

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
$2p\ {}^3P_2$ $^3P_1$ $^3P_0$	$2s^2\ 2p^4$	$2p^4\ {}^3P$	2 1 0	0. 0 341. 8 490. 6	−341. 8 −148. 8		$2s^2\ 2p^3(^4S°)3d$	$3d\ {}^5D°$	4 3 2 1 0	231158. 08+x 231158. 99+x 231160. 19+x 231160. 87+x 231161. 39+x	−0. 91 −1. 20 −0. 68 −0. 52
$2p\ {}^1D_2$	$2s^2\ 2p^4$	$2p^4\ {}^1D$	2	20873							
$2p\ {}^1S_0$	$2s^2\ 2p^4$	$2p^4\ {}^1S$	0	44919		$3d\ {}^3D_1$ $^3D_2$ $^3D_3$	$2s^2\ 2p^3(^4S°)3d$	$3d\ {}^3D°$	1 2 3	232064. 18 232064. 98 232067. 06	0. 80 2. 08
$2p'\ {}^3P_2$ $^3P_1$ $^3P_0$	$2s\ 2p^5$	$2p^5\ {}^3P°$	2 1 0	164797. 7 165107. 1 165281. 0	−309. 4 −173. 9		$2s^2\ 2p^3(^4S°)4s$	$4s\ {}^5S°$	2	235311. 15+x	
	$2s^2\ 2p^3(^4S°)3s$	$3s\ {}^5S°$	2	176654. 2 +x		$\overline{3p}\ {}^1P_1$	$2s^2 2p^3(^2D°)3p$	$3p'\ {}^1P$	1	235643. 1	
$3s\ {}^5S_1$	$2s^2\ 2p^3(^4S°)3s$	$3s\ {}^3S°$	1	182865. 2		$\overline{3p}\ {}^3D_1$ $^3D_2$ $^3D_3$	$2s^2 2p^3(^2D°)3p$	$3p'\ {}^3D$	1 2 3	236170. 35 236173. 07 236195. 57	2. 72 22. 50
	$2s^2\ 2p^3(^4S°)3p$	$3p\ {}^5P$	1 2 3	202609. 65+x 202620. 98+x 202640. 53+x	11. 33 19. 55	$4s\ {}^3S_1$	$2s^2\ 2p^3(^4S°)4s$	$4s\ {}^3S°$	1	236961. 63	
$3p\ {}^3P_0$ $^3P_1$ $^3P_2$	$2s^2\ 2p^3(^4S°)3p$	$3p\ {}^3P$	0 1 2	207702. 91 207699. 91 207704. 61	−3. 00 4. 70	$\overline{3p}\ {}^3F_4$ $^3F_3$ $^3F_2$	$2s^2 2p^3(^2D°)3p$	$3p'\ {}^3F$	4 3 2	237507. 91 237508. 72 237509. 37	−0. 81 −0. 65
$\overline{3s}\ {}^3D_3$ $^3D_2$ $^3D_1$	$2s^2\ 2p^3(^2D°)3s$	$3s'\ {}^3D°$	3 2 1	211866. 62 211887. 69 211900. 72	−21. 07 −13. 03	$\overline{3p}\ {}^1F_3$	$2s^2 2p^3(^2D°)3p$	$3p'\ {}^1F$	3	238323. 6	
$\overline{3s}\ {}^1D_2$	$2s^2\ 2p^3(^2D°)3s$	$3s'\ {}^1D°$	2	215069. 8		$2p'\ {}^1P_1$	$2s\ 2p^5$	$2p^5\ {}^1P°$	1	239605. 0	
$\overline{\overline{3s}}\ {}^1P_1$	$2s^2\ 2p^3(^2P°)3s$	$3s''\ {}^1P°$	1	227228. 2		$\overline{3p}\ {}^3P_2$ $^3P_1$ $^3P_0$	$2s^2 2p^3(^2D°)3p$	$3p'\ {}^3P$	2 1 0	240093. 10 240153. 34 240179. 91	−60. 24 −26. 57
$\overline{\overline{3s}}\ {}^3P_2$ $^3P_1$ $^3P_0$	$2s^2\ 2p^3(^2P°)3s$	$3s''\ {}^3P°$	2 1 0	229550. 83 229552. 44 229555. 10	−1. 61 −2. 66	$\overline{3p}\ {}^1D_2$	$2s^2 2p^3(^2D°)3p$	$3p'\ {}^1D$	2	246283. 9	
						$4p\ {}^3P_0$ $^3P_1$ $^3P_2$	$2s^2\ 2p^3(^4S°)4p$	$4p\ {}^3P$	0 1 2	246655. 10 246662. 55 246682. 67	7. 45 20. 12
						$\overline{3p}\ {}^3S_1$	$2s^2 2p^3(^2P°)3p$	$3p''\ {}^3S$	1	253313. 2	

F II—Continued

Edlén	Config.	Desig.	J	Level	Interval
	$2s^2\,2p^3(^4S^\circ)4d$	$4d\ ^3D^\circ$	1		
			2		
$\overline{\overline{4d}}\ ^3D_3$			3	254016	
$4f\ ^3F$	$2s^2\,2p^3(^4S^\circ)4f$	$4f\ ^3F$	4, 3, 2	254547.3	
$\overline{\overline{3p}}\ ^3D_3$	$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^3D$	3	254702.30	−15.06
$^3D_2$			2	254717.36	−6.60
$^3D_1$			1	254723.96	
	$2s^2\,2p^3(^4S^\circ)4f$	$4f\ ^5F$	5 to 1	254703.1 +x	
$\overline{\overline{3p}}\ ^1P_1$	$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^1P$	1	255606.0	
$\overline{\overline{3p}}\ ^3P_0$	$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^3P$	0	257253.9	14.9
$^3P_1$			1	257268.8	23.9
$^3P_2$			2	257292.7	
$\overline{\overline{3p}}\ ^1D_2$	$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^1D$	2	258930.0	
$5f\ ^5F$	$2s^2\,2p^3(^4S^\circ)5f$	$5f\ ^5F$	5 to 1	264610 +x	
$\overline{3d}\ ^3F_2$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3F^\circ$	2	264953.12	5.51
$^3F_3$			3	264958.63	7.28
$^3F_4$			4	264965.91	
$\overline{3d}\ ^1S_0$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1S^\circ$	0	264994.9	
$\overline{\overline{3d}}\ ^3G_5$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3G^\circ$	5	265255.8	−12.0
$^3G_4$			4	265267.8	−21.5
$^3G_3$			3	265289.3	
$\overline{3d}\ ^1G_4$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1G^\circ$	4	265310.1	
$\overline{\overline{3d}}\ ^3D_3$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3D^\circ$	3	265472.70	−26.04
$^3D_2$			2	265498.74	−18.40
$^3D_1$			1	265517.14	
$\overline{3d}\ ^1D_2$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1D^\circ$	2	266270.2	
$\overline{\overline{3p}}\ ^1S_0$	$2s^2\,2p^3(^2P^\circ)3p$	$3p''\ ^1S$	0	266338.4	
$\overline{\overline{3d}}\ ^3S_1$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3S^\circ$	1	266360.69	
$\overline{\overline{3d}}\ ^3P_2$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^3P^\circ$	2	266454.27	−44.85
$^3P_1$			1	266499.12	−17.23
$^3P_0$			0	266516.35	
$\overline{3d}\ ^1F_3$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1F^\circ$	3	266548.7	
$\overline{3d}\ ^1P_1$	$2s^2\,2p^3(^2D^\circ)3d$	$3d'\ ^1P^\circ$	1	267400.3	
$\overline{4s}\ ^3D_3$	$2s^2\,2p^3(^2D^\circ)4s$	$4s'\ ^3D^\circ$	3	269548.7	−15.5
$^3D_2$			2	269564.2	−10.3
$^3D_1$			1	269574.5	
$\overline{4s}\ ^1D_2$	$2s^2\,2p^3(^2D^\circ)4s$	$4s'\ ^1D^\circ$	2	270508.4	
F III $(^4S^\circ_{1\frac12})$		**Limit**	------	**282190.2**	
$\overline{3d}\ ^3F_4$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^3F^\circ$	4	282544.7	−25.0
$^3F_3$			3	282569.7	−17.2
$^3F_2$			2	282586.9	
$\overline{\overline{3d}}\ ^1D_2$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^1D^\circ$	2	282774.7	
$\overline{\overline{3d}}\ ^3P_0$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^3P^\circ$	0	282897.0	16.4
$^3P_1$			1	282913.4	34.5
$^3P_2$			2	282947.9	
$\overline{\overline{3d}}\ ^1F_3$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^1F^\circ$	3	283409.4	
$\overline{\overline{3d}}\ ^1P_1$	$2s^2\,2p^3(^2P^\circ)3d$	$3d''\ ^1P^\circ$	1	284224.8	
$\overline{\overline{3d}}\ ^3D_3$	$2s^2\,2p^3(^2P^\circ)4s$	$4s''\ ^3P^\circ$	2	286701.9	−4.7
$^3D_2$			1	286706.6	−0.7
$^3D_1$			0	286707.3	

December 1947.

F II OBSERVED TERMS*

Observed Terms

Config. 1s²+	$2s^2\,2p^4$	$2s\,2p^5$	$2s^2\,2p^3(^4S^\circ)nx$	$2s^2\,2p^3(^2D^\circ)nx'$	$2s^2\,2p^3(^2P^\circ)nx''$
nf (n≥4)			$4, 5f\ ^5F$ / $4f\ ^3F$		
nd (n≥3)	$2p^4\ ^1D$		$3d\ ^5D^\circ$ / $3, 4d\ ^3D^\circ$	$3d'\ ^3S^\circ$ / $3d'\ ^1S^\circ$ $3d'\ ^3P^\circ$ / $3d'\ ^1P^\circ$ $3d'\ ^3D^\circ$ / $3d'\ ^1D^\circ$ $3d'\ ^3F^\circ$ / $3d'\ ^1F^\circ$ $3d'\ ^3G^\circ$ / $3d'\ ^1G^\circ$	$3d''\ ^3P^\circ$ / $3d''\ ^1P^\circ$ $3d''\ ^3D^\circ$ / $3d''\ ^1D^\circ$ $3d''\ ^3F^\circ$ / $3d''\ ^1F^\circ$
np (n≥3)	$2p^4\ ^3P$	$2p^5\ ^3P^\circ$ / $2p^5\ ^1P^\circ$	$3p\ ^5P$ / $3, 4p\ ^3P$	$3p'\ ^3P$ / $3p'\ ^1P$ $3p'\ ^3D$ / $3p'\ ^1D$ $3p'\ ^3F$ / $3p'\ ^1F$	$3p''\ ^3S$ / $3p''\ ^1S$ $3p''\ ^3P$ / $3p''\ ^1P$ $3p''\ ^3D$ / $3p''\ ^1D$
ns (n≥3)	$2p^4\ ^1S$		$3, 4s\ ^5S^\circ$ / $3, 4s\ ^3S^\circ$	$3, 4s'\ ^3D^\circ$ / $3, 4s'\ ^1D^\circ$	$3, 4s''\ ^3P^\circ$ / $3s''\ ^1P^\circ$

* For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

Content:

F III

(N I sequence; 7 electrons) $Z=9$

Ground state $1s^2\,2s^2\,2p^3\,{}^4S^{\circ}_{1\frac{1}{2}}$

$2p^3\,{}^4S^{\circ}_{1\frac{1}{2}}$ *505410* cm^{-1} I. P. 62.646 volts

    The terms are from the paper by Edlén. With the aid of observations in the extreme ultra-violet he has extended the analysis by Bowen and Dingle and derived improved values of the series limits. He has found the sextet terms and estimated their position relative to the other terms. The value of x is somewhat uncertain. Bowen found 14 intersystem combinations connecting the doublet and quartet terms.

    The term $3p''\,{}^2P^{\circ}$ depends upon the combination with $3s''\,{}^2S$, assigned to a pair of lines at 2920 A. According to Edlén this classification is somewhat uncertain.

<div align="center">REFERENCES</div>

H. Dingle, Proc. Roy. Soc. (London) [A] **122**, 144 (1929). (T) (C L)
I. S. Bowen, Phys. Rev. **45**, 82 (1934). (T) (C L)
B. Edlén, Zeit. Phys. **93**, 433 (1935). (I P) (T) (C L)

<div align="center">F III   F III</div>

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
$2p\,{}^4S_2$	$2s^2\,2p^3$	$2p^3\,{}^4S^{\circ}$	$1\frac{1}{2}$	*0*		$3s\,{}^2P_1$ ${}^2P_2$	$2s^2\,2p^2({}^3P)3s$	$3s\,{}^2P$	$\frac{1}{2}$ $1\frac{1}{2}$	*324489. 9* *324874. 4*	*384. 5*
$2p\,{}^2D_3$ ${}^2D_2$	$2s^2\,2p^3$	$2p^3\,{}^2D^{\circ}$	$2\frac{1}{2}$ $1\frac{1}{2}$	*34084* *34120*	-36	$\overline{3s}\,{}^2D_3$ ${}^2D_2$	$2s^2\,2p^2({}^1D)3s$	$3s'\,{}^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	*344016. 2* *344019. 5*	-3.3
$2p\,{}^2P_{12}$	$2s^2\,2p^3$	$2p^3\,{}^2P^{\circ}$	$\{\,{}^{1\frac{1}{2}}_{\frac{1}{2}}\,\}$	*51558*		$3p\,{}^2S_1$	$2s^2\,2p^2({}^3P)3p$	$3p\,{}^2S^{\circ}$	$\frac{1}{2}$	*344438. 4*	
$2p'\,{}^4P_3$ ${}^4P_2$ ${}^4P_1$	$2s\,2p^4$	$2p^4\,{}^4P$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	151897. 9 152235. 3 152410. 0	-337.4 -174.7	$3p\,{}^4D_1$ ${}^4D_2$ ${}^4D_3$ ${}^4D_4$	$2s^2\,2p^2({}^3P)3p$	$3p\,{}^4D^{\circ}$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$ $3\frac{1}{2}$	*348700. 5* *348815. 4* *349005. 1* *349264. 0*	114. 9 189. 7 258. 9
$2p'\,{}^2D_3$ ${}^2D_2$	$2s\,2p^4$	$2p^4\,{}^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	210240 210256	-16	$3p\,{}^4P_1$ ${}^4P_2$ ${}^4P_3$	$2s^2\,2p^2({}^3P)3p$	$3p\,{}^4P^{\circ}$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	*351234. 1* *351328. 4* *351517. 1*	94. 3 188. 7
$2p'\,{}^2S_1$	$2s\,2p^4$	$2p^4\,{}^2S$	$\frac{1}{2}$	248260							
$2p'\,{}^2P_2$ ${}^2P_1$	$2s\,2p^4$	$2p^4\,{}^2P$	$1\frac{1}{2}$ $\frac{1}{2}$	266559 266943	-384	$3p\,{}^2D_2$ ${}^2D_3$	$2s^2\,2p^2({}^3P)3p$	$3p\,{}^2D^{\circ}$	$1\frac{1}{2}$ $2\frac{1}{2}$	*355979. 6* *356370. 0*	390. 4
$3s\,{}^4P_1$ ${}^4P_2$ ${}^4P_3$	$2s^2\,2p^2({}^3P)3s$	$3s\,{}^4P$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	316707. 3 316918. 6 317237. 5	211. 3 318. 9	$3p\,{}^4S_2$	$2s^2\,2p^2({}^3P)3p$	$3p\,{}^4S^{\circ}$	$1\frac{1}{2}$	*357477. 0*	

F III—Continued

Edlén	Config.	Desig.	J	Level	Interval
$3p\ ^2P_1$ $^2P_2$	$2s^2\ 2p^2(^3P)3p$	$3p\ ^2P°$	½ 1½	360346.2 360433.1	86.9
$\overline{\overline{3s}}\ ^2S_1$	$2s^2\ 2p^2(^1S)3s$	$3s''\ ^2S$	½	372673.0	
$\overline{3p}\ ^2F_3$ $^2F_4$	$2s^2\ 2p^2(^1D)3p$	$3p'\ ^2F°$	2½ 3½	376806.2 376871.0	64.8
$\overline{3p}\ ^2D_3$ $^2D_2$	$2s^2\ 2p^2(^1D)3p$	$3p'\ ^2D°$	2½ 1½	380242.9 380299.1	−56.2
$\overline{3p}\ ^2P_1$ $^2P_2$	$2s^2\ 2p^2(^1D)3p$	$3p'\ ^2P°$	½ 1½	384350.9 384485.2	134.3
$3d\ ^4F_2$ $^4F_3$ $^4F_4$ $^4F_5$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^4F$	1½ 2½ 3½ 4½	387257.3 387366.2 387521.8 387725.5	108.9 155.6 203.7
$3d\ ^2P_2$ $^2P_1$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^2P$	1½ ½	389523.5 389735.7	−212.2
$3d\ ^4D_1$ $^4D_2$ $^4D_3$ $^4D_4$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^4D$	½ 1½ 2½ 3½	390118.4 390078.3 390075.7 390208.4	−40.1 −2.6 132.7
$3d\ ^4P_3$ $^4P_2$ $^4P_1$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^4P$	2½ 1½ ½	390832.3 390974.0 391045.2	−141.7 −71.2
$3d\ ^2F_3$ $^2F_4$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^2F$	2½ 3½	391255.6 391625.5	369.9
$3s'\ ^6S_3$	$2s\ 2p^3(^5S°)3s$	$3s'''\ ^6S°$	2½	391910.0 +x	
$3d\ ^2D_2$ $^2D_3$	$2s^2\ 2p^2(^3P)3d$	$3d\ ^2D$	1½ 2½	395266.1 395384.1	118.0
$2p''\ ^2P_2$ $^2P_1$	$2p^5$	$2p^5\ ^2P°$	1½ ½	401203 401721	−518
$3s'\ ^4S_2$	$2s\ 2p^3(^5S°)3s$	$3s'''\ ^4S°$	1½	404778	
$\overline{3p}\ ^2P_1$ $^2P_2$	$2s^2\ 2p^2(^1S)3p$	$3p''\ ^2P°$	½ 1½	406899.2 406903.3	4.1
$\overline{3d}\ ^2F_4$ $^2F_3$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2F$	3½ 2½	413136.1 413187.1	−51.0
$\overline{3d}\ ^2G_5$ $^2G_4$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2G$	4½ 3½	414887.0 414890.1	−3.1
$4s\ ^4P_1$ $^4P_2$ $^4P_3$	$2s^2\ 2p^2(^3P)4s$	$4s\ ^4P$	½ 1½ 2½	415188 415714	
$\overline{3d}\ ^2D_2$ $^2D_3$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2D$	1½ 2½	416160.7 416178.1	17.4
$4s\ ^2P_1$ $^2P_2$	$2s^2\ 2p^2(^3P)4s$	$4s\ ^2P$	½ 1½	417581 417968	387
$\overline{3d}\ ^2P_1$ $^2P_2$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2P$	½ 1½	418180.6 418240.9	60.3
$\overline{3d}\ ^2S_1$	$2s^2\ 2p^2(^1D)3d$	$3d'\ ^2S$	½	420997.9	
$3p'\ ^6P_2$ $^6P_3$ $^6P_4$	$2s\ 2p^3(^5S°)3p$	$3p'''\ ^6P$	1½ 2½ 3½	425239.6 +x 425261.3 +x 425297.4 +x	21.7 36.1
$4p\ ^2S_1$	$2s^2\ 2p^2(^3P)4p$	$4p\ ^2S°$	½	425388.9	

F III—Continued

Edlén	Config.	Desig.	J	Level	Interval
$4p\ ^4D_1$ $^4D_2$ $^4D_3$ $^4D_4$	$2s^2\ 2p^2(^3P)4p$	$4p\ ^4D°$	½ 1½ 2½ 3½	426426.0 426556.4 426730.7 426987.5	130.4 174.3 256.8
$4p\ ^4P_1$ $^4P_2$ $^4P_3$	$2s^2\ 2p^2(^3P)4p$	$4p\ ^4P°$	½ 1½ 2½	427456.7 427542.4 427729.3	85.7 186.9
$4p\ ^2D_2$ $^2D_3$	$2s^2\ 2p^2(^3P)4p$	$4p\ ^2D°$	1½ 2½	429105.3 429500.6	395.3
$4p\ ^2P_1$ $^2P_2$	$2s^2\ 2p^2(^3P)4p$	$4p\ ^2P°$	½ 1½	431057.1 431224.2	167.1
$3p'\ ^4P_3$ $^4P_2$ $^4P_1$	$2s\ 2p^3(^5S°)3p$	$3p'''\ ^4P$	2½ 1½ ½	434546.3 434567.0 434581.6	−20.7 −14.6
$\overline{4s}\ ^2D_{23}$	$2s^2\ 2p^2(^1D)4s$	$4s'\ ^2D$	{ 2½ 1½ }	440830	
$4d\ ^2P_2$ $^2P_1$	$2s^2\ 2p^2(^3P)4d$	$4d\ ^2P$	1½ ½	441159 441384	−225
$4d\ ^4P_3$ $^4P_2$ $^4P_1$	$2s^2\ 2p^2(^3P)4d$	$4d\ ^4P$	2½ 1½ ½	442153 442300 442378	−147 −78
$4d\ ^2F_3$ $^2F_4$	$2s^2\ 2p^2(^3P)4d$	$4d\ ^2F$	2½ 3½	442280 442634	354
$\overline{\overline{3d}}\ ^2D_{23}$	$2s^2\ 2p^2(^1S)3d$	$3d''\ ^2D$	{ 1½ 2½ }	442760	
$4d\ ^2D_2$ $^2D_3$	$2s^2\ 2p^2(^3P)4d$	$4d\ ^2D$	1½ 2½	444960 445008	48
$3d'\ ^6D_5$ $^6D_4$ $^6D_3$ $^6D_2$ $^6D_1$	$2s\ 2p^3(^5S°)3d$	$3d'''\ ^6D°$	4½ 3½ 2½ 1½ ½	462930.1 +x 462932.7 +x 462936.5 +x 462939.9 +x 462942.4 +x	−2.6 −3.8 −3.4 −2.5
$5d\ ^4P_3$ $^4P_{12}$	$2s^2\ 2p^2(^3P)5d$	$5d\ ^4P$	2½ { 1½ ½ }	465409 465541	−132
$5d\ ^2D_{23}$	$2s^2\ 2p^2(^3P)5d$	$5d\ ^2D$	{ 1½ 2½ }	466293	
$\overline{4d}\ ^2F_{34}$	$2s^2\ 2p^2(^1D)4d$	$4d'\ ^2F$	{ 3½ 2½ }	466810	
$\overline{4d}\ ^2D_{23}$	$2s^2\ 2p^2(^1D)4d$	$4d'\ ^2D$	{ 1½ 2½ }	466964	
$\overline{4d}\ ^2P_{12}$	$2s^2\ 2p^2(^1D)4d$	$4d'\ ^2P$	{ ½ 1½ }	467798	
$3d'\ ^4D_4$ $^4D_3$ $^4D_{12}$	$2s\ 2p^3(^5S°)3d$	$3d'''\ ^4D°$	3½ 2½ { 1½ ½ }	467868.9 467869.3 467870.3	−0.4 −1.0
$3s'\ ^2D_3$ $^2D_2$	$2s\ 2p^3(^3D°)3s$	$3s^{IV}\ ^2D°$	2½ 1½	474369 474413	−44
$\overline{5d}\ ^2F_{34}$	$2s^2\ 2p^2(^1D)5d$	$5d'\ ^2F$	{ 3½ 2½ }	489494	
$\overline{5d}\ ^2D_{23}$	$2s^2\ 2p^2(^1D)5d$	$5d'\ ^2D$	{ 1½ 2½ }	490140	
$F\ \text{IV}(^3P_0)$	*Limit*	------		505410	

F III Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^3$	$\{$ $2p^3\,{}^4S°$ $2p^3\,{}^2P°$ $2p^3\,{}^2D°$		
$2s\,2p^4$	$\{$ $2p^4\,{}^2S$ $2p^4\,{}^4P$ / $2p^4\,{}^2P$ $2p^4\,{}^2D$		
$2p^5$	$2p^5\,{}^2P°$		

	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\,2p^2({}^3P)nx$	$\{$ $3,4s\,{}^4P$ $3,4s\,{}^2P$	$3p\,{}^4S°$ $3,4p\,{}^4P°$ $3,4p\,{}^4D°$ $3,4p\,{}^2S°$ $3,4p\,{}^2P°$ $3,4p\,{}^2D°$	$3\text{–}5d\,{}^4P$ $3d\,{}^4D$ $3d\,{}^4F$ $3,4d\,{}^2P$ $3\text{–}5d\,{}^2D$ $3,4d\,{}^2F$
$2s^2\,2p^2({}^1D)nx'$	$3,4s'\,{}^2D$	$3p'\,{}^2P°$ $3p'\,{}^2D°$ $3p'\,{}^2F°$	$3d'\,{}^2S$ $3,4d'\,{}^2P$ $3\text{–}5d'\,{}^2D$ $3\text{–}5d'\,{}^2F$ $3d'\,{}^2G$
$2s^2\,2p^2({}^1S)nx''$	$3s''\,{}^2S$	$3p''\,{}^2P°$	$3d''\,{}^2D$
$2s\,2p^3({}^5S°)nx'''$	$\{$ $3s'''\,{}^6S°$ $3s'''\,{}^4S°$	$3p'''\,{}^6P$ $3p'''\,{}^4P$	$3d'''\,{}^6D°$ $3d'''\,{}^4D°$
$2s\,2p^3({}^3D°)nx^{IV}$	$3s^{IV}\,{}^2D°$		

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

F IV

(C I sequence; 6 electrons) $Z=9$

Ground state $1s^2\,2s^2\,2p^2\ {}^3P_0$

$2p^2\ {}^3P_0$ **703766.4 cm^{-1}**   I. P. 87.23 volts

The first work on this spectrum was by Bowen. Edlén has greatly extended the earlier analysis. About 250 lines in the intervals 140 to 679 A and 2171 to 3176 A are now classified. The terms are from Edlén, who has rejected two terms in his published list, $4d'\ {}^3S$ and $\overline{\overline{3s}}'\ {}^3S$. Extrapolated values are entered in brackets in the table.

The singlet and triplet terms are connected by intersystem combinations. No such combinations involving quintet terms have been observed. The uncertainty x may reach 50 to 100 cm^{-1}.

REFERENCES

B. Edlén, Zeit. Phys. **92**, 19 (1934). (I P) (T) (C L)
B. Edlén, private communication (Dec. 1947). (T)

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^3P_0$	$2s^2\,2p^2$	$2p^2\ ^3P$	0	0.0	225.2
$^3P_1$			1	225.2	388.2
$^3P_2$			2	613.4	
$2p\ ^1D_2$	$2s^2\,2p^2$	$2p^2\ ^1D$	2	25241	
$2p\ ^1S_0$	$2s^2\,2p^2$	$2p^2\ ^1S$	0	53544	
$2p'\ ^5S_2$	$2s\,2p^3$	$2p^3\ ^5S°$	2	$74506\ +x$	
$2p'\ ^3D_3$	$2s\,2p^3$	$2p^3\ ^3D°$	3	147841.8	−47.1
$^3D_2$			2	147888.9	−12.7
$^3D_1$			1	147901.6	
$2p'\ ^3P_2$	$2s\,2p^3$	$2p^3\ ^3P°$	2	175237.0	−5.0
$^3P_1$			1	175242.0	−22.1
$^3P_0$			0	175264.1	
$2p'\ ^1D_2$	$2s\,2p^3$	$2p^3\ ^1D°$	2	228908	
$2p'\ ^3S_1$	$2s\,2p^3$	$2p^3\ ^3S°$	1	238297.2	
$2p'\ ^1P_1$	$2s\,2p^3$	$2p^3\ ^1P°$	1	257390	
$2p''\ ^3P_2$	$2p^4$	$2p^4\ ^3P$	2	348327.0	−443.0
$^3P_1$			1	348770.0	−193.0
$^3P_0$			0	348963.0	
$3s\ ^3P_0$	$2s^2\,2p(^2P°)3s$	$3s\ ^3P°$	0	416417.3	222.5
$^3P_1$			1	416639.8	503.6
$^3P_2$			2	417143.4	
$3s\ ^1P_1$	$2s^2\,2p(^2P°)3s$	$3s\ ^1P°$	1	423606.4	
$3p\ ^3D_1$	$2s^2\,2p(^2P°)3p$	$3p\ ^3D$	1	451819.6	261.5
$^3D_2$			2	452081.1	436.0
$^3D_3$			3	452517.1	
$3p\ ^3S_1$	$2s^2\,2p(^2P°)3p$	$3p\ ^3S$	1	456884.3	
$3p\ ^3P_0$	$2s^2\,2p(^2P°)3p$	$3p\ ^3P$	0	460215.2	170.6
$^3P_1$			1	460385.8	254.8
$^3P_2$			2	460640.6	
$3p\ ^1D_2$	$2s^2\,2p(^2P°)3p$	$3p\ ^1D$	2	469644.2	
$3d\ ^3F_2$	$2s^2\,2p(^2P°)3d$	$3d\ ^3F°$	2	492395.1	463.7
$^3F_3$			3	492858.8	347.4
$^3F_4$			4	493206.2	
$3d\ ^1D_2$	$2s^2\,2p(^2P°)3d$	$3d\ ^1D°$	2	492864	
$3d\ ^3D_1$	$2s^2\,2p(^2P°)3d$	$3d\ ^3D°$	1	497481.4	94.2
$^3D_2$			2	497575.6	153.5
$^3D_3$			3	497729.1	
$3d\ ^3P_2$	$2s^2\,2p(^2P°)3d$	$3d\ ^3P°$	2	500390.1	−212.0
$^3P_1$			1	500602.1	−114.4
$^3P_0$			0	500716.5	
$3s'\ ^5P_1$	$2s\,2p^2(^4P)3s$	$3s\ ^5P$	1	$502723.0+x$	241.4
$^5P_2$			2	$502964.4+x$	318.0
$^5P_3$			3	$503282.4+x$	
$3d\ ^1F_3$	$2s^2\,2p(^2P°)3d$	$3d\ ^1F°$	3	505421.4	
$3d\ ^1P_1$	$2s^2\,2p(^2P°)3d$	$3d\ ^1P°$	1	506514	
$3s'\ ^3P_0$	$2s\,2p^2(^4P)3s$	$3s\ ^3P$	0	519341	198
$^3P_1$			1	519539	351
$^3P_2$			2	519890	
$3p'\ ^3S_1$	$2s\,2p^2(^4P)3p$	$3p\ ^3S°$	1	534686	
$3p'\ ^5D_0$	$2s\,2p^2(^4P)3p$	$3p\ ^5D°$	0	$[538507]\ +x$	[66]
$^5D_1$			1	$538573.3+x$	135.9
$^5D_2$			2	$538709.2+x$	200.6
$^5D_3$			3	$538909.8+x$	256.3
$^5D_4$			4	$539166.1+x$	

Edlèn	Config.	Desig.	J	Level	Interval
$3p'\ ^5P_1$	$2s\,2p^2(^4P)3p$	$3p\ ^5P°$	1	$542578.3+x$	114.9
$^5P_2$			2	$542693.2+x$	202.0
$^5P_3$			3	$542895.2+x$	
$3p'\ ^3D_1$	$2s\,2p^2(^4P)3p$	$3p\ ^3D°$	1	550918	180
$^3D_2$			2	551098	268
$^3D_3$			3	551366	
	$2s\,2p^2(^4P)3p$	$3p\ ^3P°$	0		
$3p'\ ^3P_1$			1	556051	265
$^3P_2$			2	556316	
$4s\ ^3P_0$	$2s^2\,2p(^2P°)4s$	$4s\ ^3P°$	0	559747	134
$^3P_1$			1	559881	423
$^3P_2$			2	560304	
$4s\ ^1P_1$	$2s^2\,2p(^2P°)4s$	$4s\ ^1P°$	1	561267	
$\overline{3s'}\ ^3D_1$	$2s\,2p^2(^2D)3s$	$3s'\ ^3D$	1	567900	119
$^3D_2$			2	568019	156
$^3D_3$			3	568175	
$3d'\ ^5F_1$	$2s\,2p^2(^4P)3d$	$3d\ ^5F$	1	$[576581]\ +x$	[75]
$^5F_2$			2	$576656.1+x$	112.1
$^5F_3$			3	$576768.2+x$	148.4
$^5F_4$			4	$576916.6+x$	183.5
$^5F_5$			5	$577100.1+x$	
$3d'\ ^5D_0$	$2s\,2p^2(^4P)3d$	$3d\ ^5D$	0	$581806.1+x$	5.4
$^5D_1$			1	$581811.5+x$	17.1
$^5D_2$			2	$581828.6+x$	43.7
$^5D_3$			3	$581872.3+x$	105.3
$^5D_4$			4	$581977.6+x$	
$3d'\ ^5P_3$	$2s\,2p^2(^4P)3d$	$3d\ ^5P$	3	$583547\ +x$	−150
$^5P_2$			2	$583697\ +x$	−101
$^5P_1$			1	$583798\ +x$	
$3d'\ ^3P_2$	$2s\,2p^2(^4P)3d$	$3d\ ^3P$	2	585201	−224
$^3P_1$			1	585425	−106
$^3P_0$			0	585531	
$\overline{3s'}\ ^1D_2$	$2s\,2p^2(^2D)3s$	$3s'\ ^1D$	2	586263	
$4d\ ^3F_2$	$2s^2\,2p(^2P°)4d$	$4d\ ^3F°$	2	586641	
			3		
			4		
$4d\ ^1D_2$	$2s^2\,2p(^2P°)4d$	$4d\ ^1D°$	2	587130	
$3d'\ ^3F_2$	$2s\,2p^2(^4P)3d$	$3d\ ^3F$	2	588021	202
$^3F_3$			3	588223	255
$^3F_4$			4	588478	
$4d\ ^3D_1$	$2s^2\,2p(^2P°)4d$	$4d\ ^3D°$	1	589109	79
$^3D_2$			2	589188	218
$^3D_3$			3	589406	
$4d\ ^3P_2$	$2s^2\,2p(^2P°)4d$	$4d\ ^3P°$	2	590024	−177
$^3P_1$			1	590201	−61
$^3P_0$			0	590262	
$4d\ ^1F_3$	$2s^2\,2p(^2P°)4d$	$4d\ ^1F°$	3	592240	
$4d\ ^1P_1$	$2s^2\,2p(^2P°)4d$	$4d\ ^1P°$	1	592674	
$3d'\ ^3D_1$	$2s\,2p^2(^4P)3d$	$3d\ ^3D$	1	595331	72
$^3D_2$			2	595403	78
$^3D_3$			3	595481	
$\overline{3p'}\ ^1F_3$	$2s\,2p^2(^2D)3p$	$3p'\ ^1F°$	3	609811	
$\overline{3p'}\ ^1D_2$	$2s\,2p^2(^2D)3p$	$3p'\ ^1D°$	2	612830	
$\overline{3p'}\ ^1P_1$	$2s\,2p^2(^2D)3p$	$3p'\ ^1P°$	1	618889	
$5d\ ^3F_2$	$2s^2\,2p(^2P°)5d$	$5d\ ^3F°$	2	629547	
			3		
			4		

F IV—Continued

Edlén	Config.	Desig.	J	Level	Interval
$5d\ ^1D_2$	$2s^2\,2p(^2P°)5d$	$5d\ ^1D°$	2	630019	
	$2s^2\,2p(^2P°)5d$	$5d\ ^3D°$	1, 2		
$5d\ ^3D_3$			3	631126	
$5d\ ^3P_2$, $^3P_{01}$	$2s^2\,2p(^2P°)5d$	$5d\ ^3P°$	2 / 1, 0	[631426] / 631546	[−120]
$5d\ ^1F_3$	$2s^2\,2p(^2P°)5d$	$5d\ ^1F°$	3	632730	
$5d\ ^1P_1$	$2s^2\,2p(^2P°)5d$	$5d\ ^1P°$	1	632740	
$\overline{3d'}\ ^3F_{234}$	$2s\,2p^2(^2D)3d$	$3d'\ ^3F$	2, 3, 4	644224	
	$2s\,2p^2(^4P)4s$	$4s\ ^5P$	1		
$4s'\ ^5P_2$ / $^5P_3$			2 / 3	645504 +x / 645827 +x	323
	$2s\,2p^2(^2D)3d$	$3d'\ ^3P$	0 / 1 / 2	648827	
$\overline{3d'}\ ^3P_2$					
$\overline{3d'}\ ^3D_{12}$ / $^3D_3$	$2s\,2p^2(^2D)3d$	$3d'\ ^3D$	1, 2 / 3	650196 / 650342	146
	$2s^2\,2p(^2P°)6d$	$6d\ ^3D°$	1 / 2		
$6d\ ^3D_3$			3	653606	
$6d\ ^3P_2$ / $^3P_{01}$	$2s^2\,2p(^2P°)6d$	$6d\ ^3P°$	2 / 1, 0	653772 / 653833	−61
$6d\ ^1F_3$	$2s^2\,2p(^2P°)6d$	$6d\ ^1F°$	3	654469	
$\overline{3d'}\ ^3S_1$	$2s\,2p^2(^2D)3d$	$3d'\ ^3S$	1	654739	

F IV—Continued

Edlén	Config.	Desig.	J	Level	Interval
$\overline{3d'}\ ^1F_3$	$2s\,2p^2(^2D)3d$	$3d'\ ^1F$	3	657546	
$\overline{3d'}\ ^1D_2$	$2s\,2p^2(^2D)3d$	$3d'\ ^1D$	2	657800	
$\overline{3d'}\ ^1P_1$	$2s\,2p^2(^2D)3d$	$3d'\ ^1P$	1	658629	
	$2s\,2p^2(^4P)4p$	$4p\ ^3D°$	1 / 2		
$4p'\ ^3D_3$			3	662843	
	$2s\,2p^2(^4P)4p$	$4p\ ^3P°$	0 / 1		
$4p'\ ^3P_2$			2	665409	
$4d'\ ^5P_3$ / $^5P_{1\,2}$	$2s\,2p^2(^4P)4d$	$4d\ ^5P$	3 / 2, 1	675110 +x / 675309 +x	−199
$4d'\ ^3F_2$ / $^3F_3$ / $^3F_4$	$2s\,2p^2(^4P)4d$	$4d\ ^3F$	2 / 3 / 4	677467 / 677667 / 677906	200 / 239
$4d'\ ^3D_3$ / $^3D_{12}$	$2s\,2p^2(^4P)4d$	$4d\ ^3D$	1, 2 / 3	679798 / 679994	196
F v ($^2P°_{½}$)		Limit	------	**703766.4**	
	$2s\,2p^2(^4P)5p$	$5p\ ^3D°$	1 / 2		
$5p'\ ^3D_3$			3	710760	
$5d'\ ^5P_3$ / $^5P_{12}$	$2s\,2p^2(^4P)5d$	$5d\ ^5P$	3 / 2, 1	716878 +x / 717080 +x	−202
$\overline{4d'}\ ^3F_{234}$	$2s\,2p^2(^2D)4d$	$4d'\ ^3F$	2, 3, 4	738996	

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F IV Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^2$	$\{$ $2p^2\ ^1S$	$2p^2\ ^3P$ $2p^2\ ^1D$	
$2s\,2p^3$	$\{$ $2p^3\ ^5S°$ $2p^3\ ^3S°$	$2p^3\ ^3P°$ $2p^3\ ^3D°$ $2p^3\ ^1P°$ $2p^3\ ^1D°$	
$2p^4$	$2p^4\ ^3P$		

Config. $1s^2+$	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\,2p(^2P°)nx$	$\{$ 3, 4s $^3P°$; 3, 4s $^1P°$	$3p\ ^3S$ $3p\ ^3P$ $3p\ ^3D$ $3p\ ^1D$	3–6d $^3P°$ 3–6d $^3D°$ 3–5d $^3F°$ 3–5d $^1P°$ 3–5d $^1D°$ 3–6d $^1F°$
$2s\,2p^2(^4P)nx$	$\{$ 3, 4s ^5P ; 3s ^3P	$3p\ ^3S°$ 3, 4p $^3P°$ $3p\ ^5P°$ $3p\ ^5D°$ 3–5p $^3D°$	3–5d ^5P 3d ^5D 3d ^5F 3d ^3P 3, 4d ^3D 3, 4d ^3F
$2s\,2p^2(^2D)nx'$	$\{$ $3s'\ ^3D$; $3s'\ ^1D$	$3p'\ ^1P°$ $3p'\ ^1D°$ $3p'\ ^1F°$	$3d'\ ^3S$ $3d'\ ^3P$ $3d'\ ^3D$ 3, 4d' ^3F $3d'\ ^1P$ $3d'\ ^1D$ $3d'\ ^1F$

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

F V

(B ɪ sequence; 5 electrons) $Z=9$

Ground state $1s^2\,2s^2\,2p\ ^2P^\circ_{\frac{1}{2}}$

$2p\ ^2P^\circ_{\frac{1}{2}}\ \mathit{921450}$ cm^{-1} I. P. 114.214 volts

All of the terms are from an unpublished manuscript kindly furnished by Edlén. He has revised and extended his earlier analysis. The notation in the left column is from his published papers.

No intersystem combinations have been observed. The position of the quartet terms relative to the doublets may be in error by ± 100 cm^{-1} according to Edlén. This uncertainty is indicated by x in the table.

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F V

Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^2P_1$ $^2P_2$	$2s^2(^1S)2p$	$2p\ ^2P^\circ$	½ 1½	*0* *746*	746
$2p'\ ^4P_1$ $^4P_2$ $^4P_3$	$2s\,2p^2$	$2p^2\ ^4P$	½ 1½ 2½	86035+x 86287+x 86651+x	252 364
$2p'\ ^2D_3$ $^2D_2$	$2s\,2p^2$	$2p^2\ ^2D$	2½ 1½	152876 152898	−22
$2p'\ ^2S_1$	$2s\,2p^2$	$2p^2\ ^2S$	½	197565	
$2p'\ ^2P_1$ $^2P_2$	$2s\,2p^2$	$2p^2\ ^2P$	½ 1½	214881 215348	467
$2p''\ ^4S_2$	$2p^3$	$2p^3\ ^4S^\circ$	1½	*276657+x*	
$2p''\ ^2D_3$ $^2D_2$	$2p^3$	$2p^3\ ^2D^\circ$	2½ 1½	*307226* *307273*	−47
$2p''\ ^2P_1$ $^2P_2$	$2p^3$	$2p^3\ ^2P^\circ$	½ 1½	*347418* *347438*	20
$3s\ ^2S_1$	$2s^2(^1S)3s$	$3s\ ^2S$	½	524751	
$3p\ ^2P_1$ $^2P_2$	$2s^2(^1S)3p$	$3p\ ^2P^\circ$	½ 1½	*565367* *565544*	177
$3d\ ^2D_2$ $^2D_3$	$2s^2(^1S)3d$	$3d\ ^2D$	1½ 2½	602476 602516	40
$3s'\ ^4P_1$ $^4P_2$ $^4P_3$	$2s\,2p(^3P^\circ)3s$	$3s\ ^4P^\circ$	½ 1½ 2½	*621138+x* *621395+x* *621863+x*	257 468

F V

Edlén	Config.	Desig.	J	Level	Interval
$3s'\ ^2P_1$ $^2P_2$	$2s\,2p(^3P^\circ)3s$	$3s\ ^2P^\circ$	½ 1½	*638856* *639365*	509
$3p'\ ^2P_1$ $^2P_2$	$2s\,2p(^3P^\circ)3p$	$3p\ ^2P$	½ 1½	656208 656436	228
$3p'\ ^4D_1$ $^4D_2$ $^4D_3$ $^4D_4$	$2s\,2p(^3P^\circ)3p$	$3p\ ^4D$	½ 1½ 2½ 3½	657988+x 658134+x 658390+x 658791+x	146 256 401
$3p'\ ^4S_2$	$2s\,2p(^3P^\circ)3p$	$3p\ ^4S$	1½	666240+x	
$3p'\ ^2D_2$ $^2D_3$	$2s\,2p(^3P^\circ)3p$	$3p\ ^2D$	1½ 2½	675932 676422	490
$3p'\ ^2S_1$	$2s\,2p(^3P^\circ)3p$	$3p\ ^2S$	½	687806	
$3d'\ ^4D_{12}$ $^4D_3$ $^4D_4$	$2s\,2p(^3P^\circ)3d$	$3d\ ^4D^\circ$	{ ½ 1½ } 2½ 3½	697817+x 697919+x 698055+x	102 136
$3d'\ ^2D_2$ $^2D_3$	$2s\,2p(^3P^\circ)3d$	$3d\ ^2D^\circ$	1½ 2½	*699293* *699389*	96
$3d'\ ^4P_3$ $^4P_2$ $^4P_1$	$2s\,2p(^3P^\circ)3d$	$3d\ ^4P^\circ$	2½ 1½ ½	702908+x 703117+x 703259+x	−209 −142
$\overline{3s'}\ ^2P_{12}$	$2s\,2p(^1P^\circ)3s$	$3s'\ ^2P^\circ$	{ ½ 1½ }	*712755*	

F v—Continued

Edlén	Config.	Desig.	J	Level	Interval
3d' ²F₃ / ²F₄	2s 2p(³P°)3d	3d ²F°	2½ / 3½	712840 / 713306	466
4s ²S₁	2s²(¹S)4s	4s ²S	½	712936	
3d' ²P₂ / ²P₁	2s 2p(³P°)3d	3d ²P°	1½ / ½	718472 / 718691	−219
4d ²D₂ / ²D₃	2s²(¹S)4d	4d ²D	1½ / 2½	744010 / 744036	26
3p̄' ²D₂ / ²D₃	2s 2p(¹P°)3p	3p' ²D	1½ / 2½	751406 / 751452	46
3p̄' ²P₁ / ²P₂	2s 2p(¹P°)3p	3p' ²P	½ / 1½	752529 / 753656	127
3p̄' ²S₁	2s 2p(¹P°)3p	3p' ²S	½	760342	
3d̄' ²F₃₄	2s 2p(¹P°)3d	3d' ²F°	{ 2½ / 3½ }	783650	
3s'' ⁴P₁ / ⁴P₂ / ⁴P₃	2p²(³P)3s	3s'' ⁴P	½ / 1½ / 2½	784343+x / 784604+x / 785014+x	261 / 410
3d̄' ²D₂ / ²D₃	2s 2p(¹P°)3d	3d' ²D°	1½ / 2½	787725 / 787764	39
3d̄' ²P₁₂	2s 2p(¹P°)3d	3d' ²P°	{ ½ / 1½ }	793308	
3s'' ²P₁ / ²P₂	2p²(³P)3s	3s'' ²P	½ / 1½	797059 / 797519	460
5d ²D₃	2s²(¹S)5d	5d ²D	1½ / 2½	808663 / 808677	14
4s' ⁴P₃	2s 2p(³P°)4s	4s ⁴P°	½ / 1½ / 2½	810298+x	
3s'' ²D	2p²(¹D)3s	3s''' ²D	{ 1½ / 2½ }	811075	
3p'' ⁴D₄	2p²(³P)3p	3p'' ⁴D°	½ / 1½ / 2½ / 3½	816518+x / 816759+x / 817101+x	241 / 342
3p'' ⁴P₃	2p²(³P)3p	3p'' ⁴P°	½ / 1½ / 2½	823375+x / 823625+x	250
	2s 2p(³P°)4p	4p ²P	½ / 1½	829436 / 829707	271
4p' ²D₂ / ²D₃	2s 2p(³P°)4p	4p ²D	1½ / 2½	833501 / 833920	419
3p'' ⁴S₂	2p²(³P)3p	3p'' ⁴S°	1½	834790+x	
	2s 2p(³P°)4p	4p ²S	½	838036	
4d' ⁴D₄	2s 2p(³P°)4d	4d ⁴D°	{ ½ / 1½ } 2½ / 3½	841037+x / 841095+x / 841305+x	58 / 210

F v—Continued

Eglén	Config.	Desig.	J	Level	Interval
	2s 2p(³P°)4d	4d ²D°	1½ / 2½	841598 / 841695	97
4d' ⁴P₃	2s 2p(³P°)4d	4d ⁴P°	2½ / 1½ / ½	842452+x	
	2s²(¹S)6d	6d ²D	1½ / 2½	843497	
3p'' ²F₃ / ²F₄	2p²(¹D)3p	3p''' ²F°	2½ / 3½	844112 / 844266	154
4d' ²F₃ / ²F₄	2s 2p(³P°)4d	4d ²F°	2½ / 3½	847506 / 847817	311
	2p²(³P)3d	3d'' ²P	1½ / ½	853035 / 853442	−407
	2p²(¹D)3p	3p''' ²D°	1½ / 2½	854971	
3d'' ⁴P₃ / ⁴P₂ / ⁴P₁	2p²(³P)3d	3d'' ⁴P	2½ / 1½ / ½	860421+x / 860619+x / 860725+x	−198 / −106
3d'' ²D	2p²(¹D)3d	3d''' ²D	{ 1½ / 2½ }	873904	
3d'' ²F₃₄	2p²(¹D)3d	3d''' ²F	{ 2½ / 3½ }	880312	
3d'' ²P₁ / ²P₂	2p²(¹D)3d	3d''' ²P	½ / 1½	882930 / 883083	153
	2s 2p(³P°)5s	5s ⁴P°	½ / 1½ / 2½	892180+x	
	2s 2p(³P°)5p	5p ²D	1½ / 2½	901487 / 902012	525
5d' ⁴D	2s 2p(³P°)5d	5d ⁴D°	½ / 1½ / 2½ / 3½	906074+x	
	2s 2p(³P°)5d	5d ⁴P°	2½ / 1½ / ½	906565+x	
	F vɪ (¹S₀)	**Limit**	------	**921450**	
	2s 2p(³P°)6d	6d ⁴D°	½ / 1½ / 2½ / 3½	940921+x	
	2s 2p(³P°)6d	6d ⁴P°	2½ / 1½ / ½	941286+x	
	2p²(³P)4d	4d'' ⁴P	2½ / 1½ / ½	998189+x	

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F v Observed Terms*

Config. 1s²+	Observed Terms		
2s²(¹S)2p	2p ²P°		
2s 2p²	{2p² ²S 2p² ⁴P / 2p² ²P 2p² ²D		
2p³	{2p³ ⁴S° / 2p³ ²P° 2p³ ²D°		

Config. 1s²+	ns (n≥3)	np (n≥3)	nd (n≥3)
2s²(¹S)nx	3, 4s ²S	3p ²P°	3–6d ²D
2s 2p(³P°)nx	{ 3–5s ⁴P° / 3s ²P°	3p ⁴S 3p ⁴D / 3, 4p ²S 3, 4p ²P 3–5p ²D	3–6d ⁴P° 3–6d ⁴D° / 3d ²P° 3, 4d ²D° 3, 4d ²F°
2s 2p(¹P°)nx'	3s' ²P°	3p' ²S 3p' ²P 3p' ²D	3d' ²P° 3d' ²D° 3d' ²F°
2p²(³P)nx''	{ 3s'' ⁴P / 3s'' ²P	3p'' ⁴S° 3p'' ⁴P° 3p'' ⁴D°	3, 4d'' ⁴P / 3d'' ²P
2p²(¹D)nx'''	3s''' ²D	3p''' ²D° 3p''' ²F°	3d''' ²P 3d''' ²D 3d''' ²F

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

F VI

(Be I sequence; 4 electrons) $Z=9$

Ground state $1s^2\,2s^2\,{}^1S_0$

$2s^2\,{}^1S_0$ **1267581 cm⁻¹**   I. P. 157.117 volts

Edlén has revised and extended his published analysis and has generously furnished a manuscript copy of his complete term list in advance of publication, for inclusion here.

In the published papers he has used a prime to designate the terms from the ²P° limit in F VII.

Intersystem combinations connecting the singlet and triplet systems of terms, have been observed.

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F VI **F VI**

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$2s^2$	$2s^2\ ^1S$	0	0		$2p(^2P°)3d$	$3d\ ^3P°$	2	*938524*	-287
$2s(^2S)2p$	$2p\ ^3P°$	0	*96601*				1	*938811*	-147
		1	*96861*	260			0	*938958*	
		2	*97437*	576	$2p(^2P°)3d$	$3d\ ^1F°$	3	*947305*	
$2s(^2S)2p$	$2p\ ^1P°$	1	*186841*		$2p(^2P°)3d$	$3d\ ^1P°$	1	*953402*	
$2p^2$	$2p^2\ ^3P$	0	251341		$2s(^2S)4s$	$4s\ ^3S$	1	*989928*	
		1	251635	294					
		2	252145	510	$2s(^2S)4s$	$4s\ ^1S$	0	*997693*	
$2p^2$	$2p^2\ ^1D$	2	274597		$2s(^2S)4p$	$4p\ ^1P°$	1	*1007852*	
$2p^2$	$2p^2\ ^1S$	0	340424		$2s(^2S)4d$	$4d\ ^3D$	1		
$2s(^2S)3s$	$3s\ ^3S$	1	747298				2		
$2s(^2S)3s$	$3s\ ^1S$	0	764392				3	1014439	
$2s(^2S)3p$	$3p\ ^1P°$	1	*787833*		$2s(^2S)4d$	$4d\ ^1D$	2	1019363	
$2s(^2S)3p$	$3p\ ^3P°$	0			$2s(^2S)5s$	$5s\ ^3S$	1	1093463	
		1	*790326*	148	$2s(^2S)5p$	$5p\ ^1P°$	1	*1099409*	
		2	*790474*		$2s(^2S)5d$	$5d\ ^3D$	1		
$2s(^2S)3d$	$3d\ ^3D$	1, 2	812169	39			2		
		3	812208				3	1106417	
$2s(^2S)3d$	$3d\ ^1D$	2	826853		$2s(^2S)5d$	$5d\ ^1D$	2	1108712	
$2p(^2P°)3s$	$3s\ ^3P°$	0	*871160*		$2p(^2P°)4s$	$4s\ ^1P°$	1	*1112328*	
		1	*871441*	281	$2p(^2P°)4p$	$4p\ ^1P$	1	1115967	
		2	*872078*	637	$2p(^2P°)4p$	$4p\ ^3D$	1	1117498	
$2p(^2P°)3s$	$3s\ ^1P°$	1	*884290*				2	1117741	243
$2p(^2P°)3p$	$3p\ ^1P$	1	895287				3	1118273	532
$2p(^2P°)3p$	$3p\ ^3D$	1	900442		$2p(^2P°)4p$	$4p\ ^3S$	1	1121377	
		2	900785	343	$2p(^2P°)4p$	$4p\ ^3P$	0		
		3	901397	612			1	1122468	
$2p(^2P°)3p$	$3p\ ^3S$	1	909316				2	1122662	194
$2p(^2P°)3p$	$3p\ ^3P$	0	915196		$2p(^2P°)4p$	$4p\ ^1D$	2	1126152	
		1	915420	224	$2p(^2P°)4d$	$4d\ ^1D°$	2	*1126168*	
		2	915770	350	$2p(^2P°)4d$	$4d\ ^3D°$	1		
$2p(^2P°)3d$	$3d\ ^1D°$	2	*921821*				2		
$2p(^2P°)3p$	$3p\ ^1D$	2	925393				3	*1130339*	
$2p(^2P°)3d$	$3d\ ^3D°$	1	*933586*		$2p(^2P°)4d$	$4d\ ^3P°$	2	*1131653*	
		2	*933717*	131			1	*1131857*	-204
		3	*933920*	203			0		
$2p(^2P°)3p$	$3p\ ^1S$	0	934633		$2p(^2P°)4d$	$4d\ ^1F°$	3	*1135953*	
					$2p(^2P°)4d$	$4d\ ^1P°$	1	*1137535*	

F VI—Continued   F VI—Continued

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
2s(²S)6p	6p ¹P°	1	*1154428*		2p(²P°)5d	5d ³D°	1		
2s(²S)6d	6d ³D	1					2		
		2					3	*1220940*	
		3	1156097		2p(²P°)5d	5d ³P°	2	*1221541*	
2s(²S)6d	6d ¹D	2	1157385				1		
2s(²S)7p	7p ¹P°	1	*1184469*				0		
2s(²S)7d	7d ³D	1			2p(²P°)5d	5d ¹F°	3	*1223598*	
		2			2p(²P°)5d	5d ¹P°	1	*1224285*	
		3	1185884		2p(²P°)6p	6p ³D	1		
3s(²S)7d	7d ¹D	2	1186611				2		
2s(²S)8d	8d ³D	1					3	1266672	
		2			F VII (²S½)	*Limit*	--------	**1267581**	
		3	1205139		2p(²P°)6p	6p ³P	0		
2p(²P°)5p	5p ³D	1					1		
		2					2	1267616	
		3	1215055		2p(²P°)6p	6p ¹D	2	1268554	
2p(³P°)5p	5p ³P	0			2p(²P°)6d	6d ³D°	1		
		1					2		
		2	1216995				3	*1269888*	
2p(²P°)5p	5p ¹D	2	1218588		2p(²P°)6d	6d ¹F°	3	*1271437*	
2p(²P°)5d	5d ¹D°	2	*1218786*		2p(²P°)7d	7d ³D°	1		
							2		
							3	*1299418*	

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F VI OBSERVED TERMS*

Config. 1s²+	Observed Terms		
2s²	2s² ¹S		
2s(²S)2p	{ 2p ³P° 2p ¹P°		
2p²	{ 2p² ¹S 2p² ³P 2p² ¹D		
	ns (n≥3)	np (n≥3)	nd (n≥3)
2s(²S)nx	{ 3–5s ³S 3, 4s ¹S	3p ³P° 3–7p ¹P°	3–8d ³D 3–7d ¹D
2p(²P°)nx	{ 3s ³P° 3, 4s ¹P°	3, 4p ³S 3–6p ³P 3–6p ³D 3p ¹S 3, 4p ¹P 3–6p ¹D	3–5d ³P° 3–7d ³D° 3–5d ¹P° 3–5d ¹D° 3–6d ¹F°

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

F VII

(Li I sequence; 3 electrons) $Z=9$

Ground state $1s^2\,2s\,{}^2S_{\frac{1}{2}}$

$2s\,{}^2S_{\frac{1}{2}}$ **1493656** cm^{-1} I. P. 185.139 volts

The analysis is by Edlén, who, in 1934, published a list of nine classified lines in the range between 86 A and 134 A. He has recently extended the analysis and has generously furnished his unpublished term list for use in the present compilation. All terms in the table have been taken from the later list, although the entries in column one are from the earlier paper.

Edlén remarks that the $np\,{}^2P°$ and $nd\,{}^2D$ series have been observed in the vacuum spark further than indicated in the table, but beyond $n=6$ the term values calculated from a Ritz formula are probably to be preferred.

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F VII

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
$2s\,{}^2S$	$2s$	$2s\,{}^2S$	½	0			$6s$	$6s\,{}^2S$	½	1339216	
$2p\,{}^2P_1$ $\,{}^2P_2$	$2p$	$2p\,{}^2P°$	½ 1½	112258 113235	977		$6p$	$6p\,{}^2P°$	{ ½ 1½ }	1342877	
$3s\,{}^2S$	$3s$	$3s\,{}^2S$	½	854625			$6d$	$6d\,{}^2D$	{ 1½ 2½ }	1344141	
$3p\,{}^2P_1$ $\,{}^2P_2$	$3p$	$3p\,{}^2P°$	½ 1½	885136 885418	282		$7s$	$7s\,{}^2S$	½	1380775	
$3d\,{}^2D_2$ $\,{}^2D_3$	$3d$	$3d\,{}^2D$	1½ 2½	895632 895722	90		$7p$	$7p\,{}^2P°$	{ ½ 1½ }	1382858	
$4s\,{}^2S$	$4s$	$4s\,{}^2S$	½	1140416			$7d$	$7d\,{}^2D$	{ 1½ 2½ }	1383841	
$4p\,{}^2P_2$	$4p$	$4p\,{}^2P°$	{ ½ 1½ }	1152977			$8p$	$8p\,{}^2P°$	{ ½ 1½ }	1408848	
$4d\,{}^2D_3$	$4d$	$4d\,{}^2D$	1½ 2½	1157223 1157255	32		$8d$	$8d\,{}^2D$	{ 1½ 2½ }	1409538	
	$5s$	$5s\,{}^2S$	½	1269826							
	$5p$	$5p\,{}^2P°$	{ ½ 1½ }	1276194		F VIII ($^1S_0$)		Limit	------	**1493656**	
$5d\,{}^2D_3$	$5d$	$5d\,{}^2D$	{ 1½ 2½ }	1278404							

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F VIII

(He I sequence; 2 electrons) $Z=9$

Ground state $1s^2\,{}^1S_0$

$1s^2\,{}^1S_0$ **7693400** ± 800 cm^{-1} I. P. 953.60 $\pm$ 0.10 volts

Flemberg has classified three lines between 13 A and 16 A as the first three members of the singlet series. Tyrén has also observed the first two members of this series and classified a line at 16.951 A as the intersystem combination $1s^2\,{}^1S_0 - 2p\,{}^3P_1^\circ$. Tyrén's value of the limit is quoted here. The unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

Edlén has extended the analysis and has generously furnished his unpublished manuscript containing absolute values of the triplet terms extrapolated along the He I isoelectronic sequence. The relative positions of the singlet and triplet terms thus determined confirm the intersystem combination reported by Tyrén. The $2s\,{}^3S - 2p\,{}^3P^\circ$ combination has apparently not been observed, but Edlén regards the extrapolation from the irregular doublet law as very reliable. Brackets are used in the table to denote extrapolated values not yet confirmed by observation.

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F VIII / F VIII

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$1s^2$	$1s^2\,{}^1S$	0	0		$1s\,3d$	$3d\,{}^3D$	3, 2, 1	[6912360]	
$1s\,2s$	$2s\,{}^3S$	1	[5829920]		$1s\,3p$	$3p\,{}^1P^\circ$	1	6916590	
$1s\,2p$	$2p\,{}^3P^\circ$	0	[5899150]	[160]	$1s\,4p$	$4p\,{}^1P^\circ$	1	7256680	
		1	5899310	[950]					
		2	[5900260]						
$1s\,2p$	$2p\,{}^1P^\circ$	1	5949900		F IX ($^2S_{1/2}$)	*Limit*	--------	7693400	

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NEON

Ne I

10 electrons $Z=10$

Ground state $1s^2\, 2s^2\, 2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ **173931.7** cm^{-1} I. P. 21.559 volts

The present list has been compiled from an unpublished manuscript kindly furnished by Edlén, who has made a study of the terms of this spectrum and interpreted them with the aid of present atomic theory. His term array is based on that published by Meggers and Humphreys in 1933, although he has revised and extended their list. Three place values are from measures made with the interferometer. His predicted values of five f-levels are entered in brackets in the table.

Edlén has determined the new values of the series limits quoted here.

The classical work by Paschen on Ne I forms the basis of all subsequent investigations. His notation has, therefore, been retained in column one of the table, except for his fractional numerical prefixes for levels from an s-configuration, $m=1.5$, 2.5, etc., which are listed as 1, 2, etc., in accord with the 1933 term table mentioned above. The letters U, V, X, Y, Z adopted later when configurations involving f-electrons were found, are also entered in this column. Eleven levels in the latter group have J-values fixed by the observed combinations listed in the 1933 reference below. These J-values are entered in italics in the table.

Edlén suggested that a pair-coupling notation be adopted for Ne-like spectra to take into account the departure from LS-coupling. According to Shortley, LS-designations can be significantly assigned in only a few cases, in particular, for the following groups of levels:

Paschen	Desig.	Paschen	Desig.	Paschen	Desig.
$(n-2)s_5$	$ns\ {}^3P_2$	$2p_{10}$	$3p\ {}^3S_1$	$2p_5$	$3p\ {}^1P_1$
$(n-2)s_4$	$ns\ {}^3P_1$				
$(n-2)s_3$	$ns\ {}^3P_0$	$2p_9$	$3p\ {}^3D_3$	$2p_4$	$3p\ {}^3P_2$
		$2p_8$	$3p\ {}^3D_2$	$2p_3$	$3p\ {}^3P_0$
$(n-2)s_2$	$ns\ {}^1P_1$	$2p_7$	$3p\ {}^3D_1$	$2p_2$	$3p\ {}^3P_1$
		$2p_6$	$3p\ {}^1D_2$	$2p_1$	$3p\ {}^1S_0$

Consequently, the jl-coupling notation in the general form suggested by Racah is here introduced. The present arrangement has been suggested by Shortley, who has made a detailed investigation of the theoretical arrangement of the "pairs," to be used as a guide in preparing the present table. Pairs are separated only the case of $np\ [\tfrac{1}{2}]$, where the interval is large.

Twenty lines of Ne I in the range between 5852 A and 7032 A have been measured relative to the primary standard, and are regarded as accurate to eight figures. They have been adopted by the International Astronomical Union as secondary standards of wavelength.

Ne I—Continued

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Ne I

Paschen	Config.	Desig.	J	Level	Obs. g	Paschen	Config.	Desig.	J	Level	Obs. g
	$2p^6$	$2p^6\ ^1$S	0	0		$3s_1''''$ $3s_1'''$	$2p^5(^2\mathrm{P}^o_{1/2})3d$	$3d'\ [2\frac{1}{2}]^o$	2 3	162410.617 162412.138	0.781 1.125
$1s_5$ $1s_4$	$2p^5(^2\mathrm{P}^o_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^o$	2 1	134043.790 134461.237	1.503 1.464	$3s_1''$ $3s_1'$	"	$3d'\ [1\frac{1}{2}]^o$	2 1	162421.944 162437.642	1.242 0.752
$1s_3$ $1s_2$	$2p^5(^2\mathrm{P}^o_{1/2})3s$	$3s'\ [\ \frac{1}{2}]^o$	0 1	134820.591 135890.670	1.034	$3p_{10}$	$2p^5(^2\mathrm{P}^o_{1\frac{1}{2}})4p$	$4p\ [\ \frac{1}{2}]$	1	162519.850	1.929
$2p_{10}$	$2p^5(^2\mathrm{P}^o_{1\frac{1}{2}})3p$	$3p\ [\ \frac{1}{2}]$	1	148259.746	1.984	$3p_9$ $3p_8$	"	$4p\ [2\frac{1}{2}]$	3 2	162832.683 162901.093	1.328 1.112
$2p_9$ $2p_8$	"	$3p\ [2\frac{1}{2}]$	3 2	149659.000 149826.181	1.329 1.137	$3p_7$ $3p_6$	"	$4p\ [1\frac{1}{2}]$	1 2	163014.600 163040.330	0.974 1.360
$2p_7$ $2p_6$	"	$3p\ [1\frac{1}{2}]$	1 2	150123.551 150317.821	0.669 1.229	$3p_3$	"	$4p\ [\ \frac{1}{2}]$	0	163403.281	
$2p_3$	"	$3p\ [\ \frac{1}{2}]$	0	150919.391		$3p_5$ $3p_4$	$2p^5(^2\mathrm{P}^o_{1/2})4p$	$4p'\ [1\frac{1}{2}]$	1 2	163659.248 163710.581	0.685 1.184
$2p_5$ $2p_4$	$2p^5(^2\mathrm{P}^o_{1/2})3p$	$3p'\ [1\frac{1}{2}]$	1 2	150774.072 150860.468	0.999 1.301	$3p_2$	"	$4p'\ [\ \frac{1}{2}]$	1 0	163709.699 164287.864	1.397
$2p_2$ $2p_1$	"	$3p'\ [\ \frac{1}{2}]$	1 0	151040.413 152972.697	1.340						
						$3s_5$ $3s_4$	$2p^5(^2\mathrm{P}^o_{1\frac{1}{2}})5s$	$5s\ [1\frac{1}{2}]^o$	2 1	165830.144 165914.756	1.492 1.207
$2s_5$ $2s_4$	$2p^5(^2\mathrm{P}^o_{1\frac{1}{2}})4s$	$4s\ [1\frac{1}{2}]^o$	2 1	158603.070 158797.954		$3s_3$ $3s_2$	$2p^5(^2\mathrm{P}^o_{1/2})5s'$	$5s'\ [\ \frac{1}{2}]^o$	0 1	166608.309 166658.484	1.295
$2s_3$ $2s_2$	$2p^5(^2\mathrm{P}^o_{1/2})4s$	$4s'\ [\ \frac{1}{2}]^o$	0 1	159381.94 159536.57		$4d_6$ $4d_5$	$2p^5(^2\mathrm{P}^o_{1\frac{1}{2}})4d$	$4d\ [\ \frac{1}{2}]^o$	0 1	166969.639 166977.321	1.391
$3d_6$ $3d_5$	$2p^5(^2\mathrm{P}^o_{1\frac{1}{2}})3d$	$3d\ [\ \frac{1}{2}]^o$	0 1	161511.590 161526.134	1.397	$4d_4'$ $4d_4$	"	$4d\ [3\frac{1}{2}]^o$	4 3	167002.007 167003.104	1.251 1.040
$3d_4'$ $3d_4$	"	$3d\ [3\frac{1}{2}]^o$	4 3	161592.308 161594.081	1.249 1.034	$4d_3$ $4d_2$	"	$4d\ [1\frac{1}{2}]^o$	2 1	167013.535 167028.957	1.322 0.812
$3d_3$ $3d_2$	"	$3d\ [1\frac{1}{2}]^o$	2 1	161609.222 161638.581	1.356 0.860	$4d_1''$ $4d_1'$	"	$4d\ [2\frac{1}{2}]^o$	2 3	167049.580 167050.639	0.990 1.248
$3d_1''$ $3d_1'$	"	$3d\ [2\frac{1}{2}]^o$	2 3	161701.623 161703.413	0.948 1.249	$4s_1''''$ $4s_1'''$	$2p^5(^2\mathrm{P}^o_{1/2})4d$	$4d'\ [2\frac{1}{2}]^o$	2 3	167796.939 167797.865	0.783 1.116

Paschen	Config.	Desig.	J	Level	Obs. g
4s₁'' 4s₁'	$2p^5(^2P^\circ_{½})4d$	4d' [1½]°	2 1	167798.914 167809.722	1.230 0.797
4X	$2p^5(^2P^\circ_{1½})4f$	4f [1½]	1, 2	167054.59	
4V	"	4f [4½]	4, 5	[167062.5]	
4Y	"	4f [2½]	2, 3	167071.08	
4Z	"	4f [3½]	3, 4	[167079.1]	
4U	$2p^5(^2P^\circ_{½})4f$	4f' [2½]	2, 3	167848.67	
4p₁₀	$2p^5(^2P^\circ_{1½})5p$	5p [½]	1	167451.44	
4p₉ 4p₈	"	5p [2½]	3 2	167561.03 167593.18	
4p₇ 4p₆	"	5p [1½]	1 2	167641.53 167650.60	
4p₃	"	5p [½]	0	167869.17	
4p₅ 4p₄	$2p^5(^2P^\circ_{½})5p$	5p' [1½]	1 2	168357.44 168380.69	
4p₂ 4p₁	"	5p' [½]	1 0	168360.57 168588.83	
4s₅ 4s₄	$2p^5(^2P^\circ_{1½})6s$	6s [1½]°	2 1	168926.626 168969.328	1.500 1.184
4s₃ 4s₂	$2p^5(^2P^\circ_{½})6s$	6s' [½]°	0 1	169707.899 169729.602	 1.313
5d₆ 5d₅	$2p^5(^2P^\circ_{1½})5d$	5d [½]°	0 1	169484.98 169490.414	 1.383
5d₄' 5d₄	"	5d [3½]°	4 3	169503.612 169504.258	 1.093
5d₃ 5d₂	"	5d [1½]°	2 1	169510.540 169518.977	1.298 0.791
5d₁'' 5d₁'	"	5d [2½]°	2 3	169528.241 169528.862	
5s₁'''' 5s₁'''	$2p^5(^2P^\circ_{½})5d$	5d' [2½]°	2 3	170291.291 170291.650	
5s₁'' 5s₁'	"	5d' [1½]°	2 1	170290.934 170297.98	1.251 0.809
5X	$2p^5(^2P^\circ_{1½})5f$	5f [1½]	1, 2	169532.22	
5V	"	5f [4½]	4, 5	[169536.3]	
5Y	"	5f [2½]	2, 3	169540.88	
5Z	"	5f [3½]	3, 4	[169545.0]	
5U	$2p^5(^2P^\circ_{½})5f$	5f' [2½]	2, 3	170319.71	
5p₁₀	$2p^5(^2P^\circ_{1½})6p$	6p [½]	1	169750.11	
5p₉ 5p₈	"	6p [2½]	3 2	169799.15 169816.60	
5p₇ 5p₆	"	6p [1½]	1 2	169841.45 169845.79	

Paschen	Config.	Desig.	J	Level	Obs. g
5p₃	$2p^5(^2P^\circ_{1½})6p$	6p [½]	0	169978.70	
5p₅ 5p₄	$2p^5(^2P^\circ_{½})6p$	6p' [1½]	1 2	170586.94 170599.19	
5p₂ 5p₁	"	6p' [½]	1 0	170580.35 170691.32	
5s₅ 5s₄	$2p^5(^2P^\circ_{1½})7s$	7s [1½]°	2 1	170534.694 170559.032	
5s₃ 5s₂	$2p^5(^2P^\circ_{½})7s$	7s' [½]°	0 1	171314.84 171325.997	 1.315
6d₆ 6d₅	$2p^5(^2P^\circ_{1½})6d$	6d [½]°	0 1	170850.252 170853.315	 1.389
6d₄' 6d₄	"	6d [3½]°	4 3	170860.447 170860.850	
6d₃ 6d₂	"	6d [1½]°	2 1	170864.959 170869.927	1.331 0.783
6d₁'' 6d₁'	"	6d [2½]°	2 3	170874.840 170875.216	0.971
6s₁'''' 6s₁'''	$2p^5(^2P^\circ_{½})6d$	6d' [2½]°	2 3	171644.139 171644.434	
6s₁'' 6s₁'	"	6d' [1½]°	2 1	171641.951 171646.87	 0.857
6X	$2p^5(^2P^\circ_{1½})6f$	6f [1½]	1, 2	170877.72	
6V	"	6f [4½]	4, 5	170879.95	
6Y	"	6f [2½]	2, 3	170882.65	
6Z	"	6f [3½]	3, 4	170884.95	
6U	$2p^5(^2P^\circ_{½})6f$	6f' [3½]	3, 4	171661.87	
	"	6f' [2½]	2, 3	171661.66	
6p₁₀	$2p^5(^2P^\circ_{1½})7p$	7p [½]	1	171011.31	
6p₉ 6p₈	"	7p [2½]	3 2	171034.80 171045.65	
6p₇ 6p₆	"	7p [1½]	1 2	171059.96 171062.18	
6p₃	"	7p [½]	0	171150.81	
6p₅ 6p₄	$2p^5(^2P^\circ_{½})7p$	7p' [1½]	1 2	171824.2 171830.0	
6p₂ 6p₁	"	7p' [½]	1 0	171832.7 171915.46	
6s₅ 6s₄	$2p^5(^2P^\circ_{1½})8s$	8s [1½]°	2 1	171475.295 171491.464	
6s₃ 6s₂	$2p^5(^2P^\circ_{½})8s$	8s' [½]°	0 1	172256.31 172263.720	
7d₆ 7d₅	$2p^5(^2P^\circ_{1½})7d$	7d [½]°	0 1	171671.14 171673.90	
7d₄' 7d₄	"	7d [3½]°	4 3	171677.455 171677.714	

Paschen	Config.	Desig.	J	Level	Obs. g	Paschen	Config.	Desig.	J	Level	Obs. g
$7d_3$ $7d_2$	$2p^5(^2P^\circ_{1\frac{1}{2}})7d$	$7d\ [1\frac{1}{2}]^\circ$	2 1	*171683.331* *171684.902*		8U	$2p^5(^2P^\circ_{\frac{1}{2}})8f$	$\begin{cases}8f'\ [3\frac{1}{2}]\\8f'\ [2\frac{1}{2}]\end{cases}$	3, 4 2, 3	}172996.63	
$7d''_1$ $7d'_1$	"	$7d\ [2\frac{1}{2}]^\circ$	2 3	*171687.268* *171687.518*		$8p_{10}$	$2p^5(^2P^\circ_{1\frac{1}{2}})9p$	$9p\ [\ \frac{1}{2}]$	1	172270.4	
$7s''''_1$ $7s'''_1$	$2p^5(^2P^\circ_{\frac{1}{2}})7d$	$7d'\ [2\frac{1}{2}]^\circ$	2 3	*172460.407* *172460.602*		$8p_9$ $8p_8$	"	$9p\ [2\frac{1}{2}]$	3 2	172284.2 172288.8	
$7s''_1$ $7s_1$	"	$7d'\ [1\frac{1}{2}]^\circ$	2 1	*172459.85* *172463.02*		$8p_{7,6}$	"	$9p\ [1\frac{1}{2}]$	1, 2	172293.4	
7X	$2p^5(^2P^\circ_{1\frac{1}{2}})7f$	$7f\ [1\frac{1}{2}]$	1, 2	171688.57		$8p_3$	"	$9p\ [\ \frac{1}{2}]$	0	172329.3	
7V	"	$7f\ [4\frac{1}{2}]$	4, 5	171689.95		$8p_4$	$2p^5(^2P^\circ_{\frac{1}{2}})9p$	$9p'\ [1\frac{1}{2}]$	1 2	173067.4	
7Y	"	$7f\ [2\frac{1}{2}]$	2, 3	171692.07							
7Z	"	$7f\ [3\frac{1}{2}]$	3, 4	171693.32		$8p_1$	"	$9p'\ [\ \frac{1}{2}]$	1 0	173099.3	
7U	$2p^5(^2P^\circ_{\frac{1}{2}})7f$	$\begin{cases}7f'\ [3\frac{1}{2}]\\7f'\ [2\frac{1}{2}]\end{cases}$	3, 4 2, 3	}172471.45		$8s_5$ $8s_4$	$2p^5(^2P^\circ_{1\frac{1}{2}})10s$	$10s\ [1\frac{1}{2}]^\circ$	2 1	*172477.303* *172483.84*	
$7p_{10}$	$2p^5(^2P^\circ_{1\frac{1}{2}})8p$	$8p\ [\ \frac{1}{2}]$	1	171754.2		$8s_3$ $8s_2$	$2p^5(^2P^\circ_{\frac{1}{2}})10s$	$10s'\ [\ \frac{1}{2}]^\circ$	0 1	*173257.24* *173261.41*	
$7p_9$ $7p_8$	"	$8p\ [2\frac{1}{2}]$	3 2	171789.0 171793.7		$9d_6$ $9d_5$	$2p^5(^2P^\circ_{1\frac{1}{2}})9d$	$9d\ [\ \frac{1}{2}]^\circ$	0 1	*172566.85* *172567.88*	
$7p_7$ $7p_6$	"	$8p\ [1\frac{1}{2}]$	1 2	171800.3 171805.1		$9d'_4$ $9d_4$	"	$9d\ [3\frac{1}{2}]^\circ$	4 3	*172569.840* *172570.064*	
$7p_3$	"	$8p\ [\ \frac{1}{2}]$	0	171833.0		$9d_3$ $9d_2$	"	$9d\ [1\frac{1}{2}]^\circ$	2 1	*172571.37* *172572.82*	
$7p_4$	$2p^5(^2P^\circ_{\frac{1}{2}})8p$	$8p'\ [1\frac{1}{2}]$	1 2	172575.4		$9d''_1$ $9d'_1$	"	$9d\ [2\frac{1}{2}]^\circ$	2 3	*172574.12* *172574.22*	
$7p_2$ $7p_1$	"	$8p'\ [\ \frac{1}{2}]$	1 0	172564.8 172601.7		$9s''''_1$ $9s'''_1$	$2p^5(^2P^\circ_{\frac{1}{2}})9d$	$9d'\ [2\frac{1}{2}]^\circ$	2 3	*173351.45* *173351.50*	
$7s_5$ $7s_4$	$2p^5(^2P^\circ_{1\frac{1}{2}})9s$	$9s\ [1\frac{1}{2}]^\circ$	2 1	*172073.375* *172082.895*		$9s''_1$ $9s'_1$	"	$9d'\ [1\frac{1}{2}]^\circ$	2 1	*173351.49* *173352.75*	
$7s_3$ $7s_2$	$2p^5(^2P^\circ_{\frac{1}{2}})9s$	$9s'\ [\ \frac{1}{2}]^\circ$	0 1	*172854.12* *172858.96*		9V	$2p^5(^2P^\circ_{1\frac{1}{2}})9f$	$9f\ [4\frac{1}{2}]$	4, 5	172575.83	
$8d_6$ $8d_5$	$2p^5(^2P^\circ_{1\frac{1}{2}})8d$	$8d\ [\ \frac{1}{2}]^\circ$	0 1	*172202.33* *172203.86*		9Y	"	$9f\ [2\frac{1}{2}]$	2, 3	172576.8	
$8d'_4$ $8d_4$	"	$8d\ [3\frac{1}{2}]^\circ$	4 3	*172207.110* *172207.278*		9Z	"	$9f\ [3\frac{1}{2}]$	3, 4	172577.3	
$8d_3$ $8d_2$	"	$8d\ [1\frac{1}{2}]^\circ$	2 1	*172208.77* *172211.10*		$9p_{10}$	$2p^5(^2P^\circ_{1\frac{1}{2}})10p$	$10p\ [\ \frac{1}{2}]$	1	172621.0	
$8d''_1$ $8d'_1$	"	$8d\ [2\frac{1}{2}]^\circ$	2 3	*172213.094* *172213.249*		$9p_9$ $9p_8$	"	$10p\ [2\frac{1}{2}]$	3 2	172625.2	
$8s''''_1$ $8s'''_1$	$2p^5(^2P^\circ_{\frac{1}{2}})8d$	$8d'\ [2\frac{1}{2}]^\circ$	2 3	*172989.185* *172989.263*		$9p_{7,6}$	"	$10p\ [1\frac{1}{2}]$	1, 2	172632.2	
$8s''_1$ $8s'_1$	"	$8d'\ [1\frac{1}{2}]^\circ$	2 1	*172989.06* *172990.96*		$9p_3$	"	$10p\ [\ \frac{1}{2}]$	0	172667.1	
8X	$2p^5(^2P^\circ_{1\frac{1}{2}})8f$	$8f\ [1\frac{1}{2}]$	1, 2	172214.66		$9s_5$ $9s_4$	$2p^5(^2P^\circ_{1\frac{1}{2}})11s$	$11s\ [1\frac{1}{2}]^\circ$	2 1	*172761.79* *172766.55*	
8V	"	$8f\ [4\frac{1}{2}]$	4, 5	172215.54?		$9s_3$ $9s_2$	$2p^5(^2P^\circ_{\frac{1}{2}})11s$	$11s'\ [\ \frac{1}{2}]^\circ$	0 1	*173542.00* *173545.28*	
8Y	"	$8f\ [2\frac{1}{2}]$	2, 3	[172216.7]		$10d_6$ $10d_5$	$2p^5(^2P^\circ_{1\frac{1}{2}})10d$	$10d\ [\ \frac{1}{2}]^\circ$	0 1	*172826.54* *172827.42*	
8Z	"	$8f\ [3\frac{1}{2}]$	3, 4	172217.64							

Paschen	Config.	Desig.	J	Level	Obs. g
$10d'_4$ $10d_4$	$2p^5(^2P^o_{1½})10d$	$10d$ [3½]°	4 3	172829.11 172829.20	
$10d_3$ $10d_2$	''	$10d$ [1½]°	2 1	172829.87 172831.28	
$10d''_1$ $10d'_1$	''	$10d$ [2½]°	2 3	172832.20 172832.24	
$10s'''''_1$ $10s'''_1$	$2p^5(^2P^o_{½})10d$	$10d'$ [2½]°	2 3	173610.45 173610.52	
$10s''_1$ $10s'_1$	''	$10d'$ [1½]°	2 1	173610.50 173611.54	
$10p_{7,6}$	$2p^5(^2P^o_{1½})11p$	$11p$ [1½]	1, 2	172873.9	
$10s_5$ $10s_4$	$2p^5(^2P^o_{1½})12s$	$12s$ [1½]°	2 1	172970.51 172974.3.'	
$11d_6$ $11d_5$	$2p^5(^2P^o_{1½})11d$	$11d$ [½]°	0 1	173019.37 173019.86	
$11d'_4$ $11d_4$	''	$11d$ [3½]°	4 3	173020.86 173020.82	
$11d_3$	''	$11d$ [1½]°	2 1	173022.02	
$11d''_1$ $11d'_1$	''	$11d$ [2½]°	2 3	173022.95 173023.27	

Paschen	Config.	Desig.	J	Level	Obs. g
$11s'''''_1$ $11s'''_1$	$2p^5(^2P^o_{½})11d$	$11d'$ [2½]°	2 3	173802.27 173802.33	
$11s'_1$	''	$11d'$ [1½]°	2 1	173802.75	
$11s_5$ $11s_4$	$2p^5(^2P^o_{1½})13s$	$13s$ [1½]°	2 1	173128.02 173130.76	
$12d_5$	$2p^5(^2P^o_{1½})12d$	$12d$ [½]°	0 1	173165.56	
$12d'_4$ $12d_4$	''	$12d$ [3½]°	4 3	173166.46 173166.43	
$12d_3$	''	$12d$ [1½]°	2 1	173167.03	
$12d''_1$ $12d'_1$	''	$12d$ [2½]°	2 3	173168.14 173168.43	
$13d_5$	$2p^5(^2P^o_{1½})13d$	$13d$ [½]°	0 1	173279.46	
$13d'_4$ $13d_4$	''	$13d$ [3½]°	4 3	173280.05 173280.12	
Ne II ($^2P^o_{1½}$)	*Limit*	------		173931.7	
Ne II ($^2P^o_{½}$)	*Limit*	------		174712.2	

March 1948.

Ne I Observed Levels*

Config. $1s^2\,2s^2+$	Observed Terms		
$2p^6$	$2p^6\,^1S$		
	ns (n≥3)	np (n≥3)	
$2p^5(^2P°)nx$	$\begin{cases}3\text{–}13s & ^3P° \\ 3\text{–}11s & ^1P°\end{cases}$	$3p\,^3S$ $3p\,^3P$ $3p\,^3D$ $3p\,^1S$ $3p\,^1P$ $3p\,^1D$	

jl-Coupling Notation

	Observed Pairs			
	ns (n≥3)	np (n≥3)	nd (n≥3)	nf (n≥4)
$2p^5(^2P°_{1½})nx$	$3\text{–}13s$ [1½]°	$3\text{–}10p$ [½] $3\text{–}10p$ [2½] $3\text{–}11p$ [1½]	$3\text{–}13d$ [½]° $3\text{–}13d$ [3½]° $3\text{–}12d$ [1½]° $3\text{–}12d$ [2½]°	4– $8f$ [1½] 6– $9f$ [4½] $4\text{–}7,\,9f$ [2½] 6– $9f$ [3½]
$2p^5(^2P°_{½})nx'$	$3\text{–}11s'$[½]°	$3\text{–}\,9p'$[1½] $3\text{–}\,9p'$[½]	$3\text{–}11d'$[2½]° $3\text{–}11d'$[1½]°	6– $8f'$[3½] 4– $8f'$[2½]

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

Ne II

(F ɪ sequence; 9 electrons) $Z=10$

Ground state $1s^2\,2s^2\,2p^5\,{}^2P^{\circ}_{1\frac{1}{2}}$

$2p^5\,{}^2P^{\circ}_{1\frac{1}{2}}$ **331350** cm^{-1} I. P. 41.07 volts

The terms are from Boyce, who has extended the analysis by further observations in the ultraviolet, and improved the earlier term values. The series limit is estimated from series of two members, the 3s and 4s terms.

Intersystem combinations connecting the doublet and quartet terms have been observed.

The values of the $3d'\,{}^2G$ and $3d'\,{}^2S$ terms have been corrected to agree with the observed combinations.

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Ne II

Config.	Desig.	J	Level	Interval	Obs. g	Config.	Desig.	J	Level	Interval	Obs. g
$2s^2\,2p^5$	$2p^5\,{}^2P^{\circ}$	$1\frac{1}{2}$	0	-782		$2s^2\,2p^4({}^3P)3d$	$3d\,{}^4D$	$3\frac{1}{2}$	279139. 1	-81.5	
		$\frac{1}{2}$	782					$2\frac{1}{2}$	279220. 6	-106.2	
								$1\frac{1}{2}$	279326. 8	-98.3	
$2s\,2p^6$	$2p^6\,{}^2S$	$\frac{1}{2}$	217050					$\frac{1}{2}$	279425. 1		
$2s^2\,2p^4({}^3P)3s$	$3s\,{}^4P$	$2\frac{1}{2}$	219133. 0	-517.8	1. 60	$2s^2\,2p^4({}^3P)3d$	$3d\,{}^4F$	$4\frac{1}{2}$	280174. 4	-528.1	
		$1\frac{1}{2}$	219650. 8	-299.1	1. 73			$3\frac{1}{2}$	280702. 5	-325.6	
		$\frac{1}{2}$	219949. 9		2. 67			$2\frac{1}{2}$	281028. 1	78. 5	
$2s^2\,2p^4({}^3P)3s$	$3s\,{}^2P$	$1\frac{1}{2}$	224089. 3	-612.5	1. 33			$1\frac{1}{2}$	280949. 6		
		$\frac{1}{2}$	224701. 8		0. 67	$2s^2\,2p^4({}^3P)3d$	$3d\,{}^2F$	$3\frac{1}{2}$	280264. 0	-535.3	
$2s^2\,2p^4({}^3P)3p$	$3p\,{}^4P^{\circ}$	$2\frac{1}{2}$	246194. 8	-222.6	1. 60			$2\frac{1}{2}$	280799. 3		
		$1\frac{1}{2}$	246417. 4	-182.5	1. 73	$2s^2\,2p^4({}^3P)3d$	$3d\,{}^2D$	$2\frac{1}{2}$	280271. 0	-204.6	
		$\frac{1}{2}$	246599. 9		2. 67			$1\frac{1}{2}$	280475. 6		
$2s^2\,2p^4({}^1D)3s$	$3s'\,{}^2D$	$2\frac{1}{2}$	246396. 5	-3.5	1. 20	$2s^2\,2p^4({}^3P)3d$	$3d\,{}^4P$	$\frac{1}{2}$	280770. 2	221. 5	
		$1\frac{1}{2}$	246400. 0		0. 80			$1\frac{1}{2}$	280991. 7	181. 8	
$2s^2\,2p^4({}^3P)3p$	$3p\,{}^4D^{\circ}$	$3\frac{1}{2}$	249110. 8	-337.2	1. 43			$2\frac{1}{2}$	281173. 5		
		$2\frac{1}{2}$	249448. 0	-249.7	1. 37	$2s^2\,2p^4({}^3P)3d$	$3d\,{}^2P$	$\frac{1}{2}$	281334. 5	387. 8	0. 70
		$1\frac{1}{2}$	249697. 7	-144.1	1. 20			$1\frac{1}{2}$	281722. 3		1. 25
		$\frac{1}{2}$	249841. 8		0. 00	$2s^2\,2p^4({}^3P)4s$	$4s\,{}^4P$	$2\frac{1}{2}$	282000. 0	-376.7	
$2s^2\,2p^4({}^3P)3p$	$3p\,{}^2D^{\circ}$	$2\frac{1}{2}$	251013. 3	-511.4	1. 20			$1\frac{1}{2}$	282376. 7	-305.5	
		$1\frac{1}{2}$	251524. 7		0. 80			$\frac{1}{2}$	282682. 2		
$2s^2\,2p^4({}^3P)3p$	$3p\,{}^2S^{\circ}$	$\frac{1}{2}$	252800. 8		1. 96	$2s^2\,2p^4({}^3P)4s$	$4s\,{}^2P$	$1\frac{1}{2}$	283323. 7	-572.8	
$2s^2\,2p^4({}^3P)3p$	$3p\,{}^4S^{\circ}$	$1\frac{1}{2}$	252956. 0					$\frac{1}{2}$	283896. 5		
$2s^2\,2p^4({}^3P)3p$	$3p\,{}^2P^{\circ}$	$1\frac{1}{2}$	254167. 0	-127.0	1. 33	$2s^2\,2p^4({}^3P)4d$	$4d\,{}^2D$	$2\frac{1}{2}$	302321?	-131	
		$\frac{1}{2}$	254294. 0		0. 71			$1\frac{1}{2}$	302452?		
$2s^2\,2p^4({}^1D)3p$	$3p'\,{}^2F^{\circ}$	$2\frac{1}{2}$	274366. 9	44. 4	0. 86	$2s^2\,2p^4({}^3P)4f$	$4f\,{}^4D^{\circ}$	$3\frac{1}{2}$	302830. 6	-14.9	
		$3\frac{1}{2}$	274411. 3		1. 14			$2\frac{1}{2}$	302845. 5	-59.7	
$2s^2\,2p^4({}^1D)3p$	$3p'\,{}^2P^{\circ}$	$1\frac{1}{2}$	276278. 6	-235.5	1. 33			$1\frac{1}{2}$	302905. 2	-86.0	
		$\frac{1}{2}$	276514. 1		0. 67			$\frac{1}{2}$	302991. 2		
$2s^2\,2p^4({}^1S)3s$	$3s''\,{}^2S$	$\frac{1}{2}$	276678. 0		2. 00	$2s^2\,2p^4({}^3P)4d$	$4d\,{}^2P$	$\left\{\begin{matrix}1\frac{1}{2}\\ \frac{1}{2}\end{matrix}\right\}$	302884?		
$2s^2\,2p^4({}^1D)3p$	$3p'\,{}^2D^{\circ}$	$1\frac{1}{2}$	277327. 6	18. 5	0. 80	$2s^2\,2p^4({}^3P)4f$	$4f\,{}^4F^{\circ}$	$4\frac{1}{2}$	302905. 8	-625.0	
		$2\frac{1}{2}$	277346. 1		1. 20			$3\frac{1}{2}$	303530. 8	-295.8	
								$2\frac{1}{2}$	303826. 8	315. 0	
								$1\frac{1}{2}$	303511. 6		

Ne II—Continued

Config.	Desig.	J	Level	Interval	Obs. g	Config.	Desig.	J	Level	Interval	Obs. g
$2s^2\,2p^4(^3P)4f$	$4f\ \ ^4G^\circ$	$5\frac{1}{2}$	303475.7	10.6		$2s^2\,2p^4(^1D)4s$	$4s'\ \ ^2D$	$\left\{\begin{array}{c}2\frac{1}{2}\\1\frac{1}{2}\end{array}\right\}$	$306018?$		
		$4\frac{1}{2}$	303465.1	-236.0							
		$3\frac{1}{2}$	303701.1	98.8		$2s^2\,2p^4(^1D)3d$	$3d'\ \ ^2D$	$1\frac{1}{2}$	306244.8	445.0	
		$2\frac{1}{2}$	303602.3					$2\frac{1}{2}$	306689.8		
$2s^2\,2p^4(^3P)4f$	$4f\ \ ^2D^\circ$	$1\frac{1}{2}$	303465.4	416.9		$2s^2\,2p^4(^1D)3d$	$3d'\ \ ^2F$	$3\frac{1}{2}$	307992.2	-111.1	
		$2\frac{1}{2}$	303882.3					$2\frac{1}{2}$	308103.3		
$2s^2\,2p^4(^1D)3d$	$3d'\ \ ^2G$	$4\frac{1}{2}$	305366.2	-1.0		$2s^2\,2p^4(^1D)3d$	$3d'\ \ ^2S$	$\frac{1}{2}$	309049.7		
		$3\frac{1}{2}$	305367.2								
$2s^2\,2p^4(^1S)3p$	$3p''^2P^\circ$	$1\frac{1}{2}$	305399.2	-10.1	1.33	$2s^2\,2p^4(^1S)3d$	$3d''^2D$	$2\frac{1}{2}$	327954.7	-13.5	
		$\frac{1}{2}$	305409.3		0.67			$1\frac{1}{2}$	327968.2		
$2s^2\,2p^4(^1D)3d$	$3d'\ \ ^2P$	$1\frac{1}{2}$	305568.9	-15.3							
		$\frac{1}{2}$	305584.2			Ne III $(^3P_2)$	$Limit$	------	331350		

March 1947.

Ne II Observed Terms*

Config. $1s^2+$	Observed Terms					
$2s^2\,2p^5$	$2p^5\ ^2P^\circ$					
$2s\,2p^6$	$2p^6\ ^2S$					
	$ns\ (n\geq 3)$			$np\ (n\geq 3)$		
$2s^2\,2p^4(^3P)nx$	$\left\{\begin{array}{l}3,\,4s\ ^4P\\3,\,4s\ ^2P\end{array}\right.$			$3p\ ^4S^\circ\quad 3p\ \ ^4P^\circ\quad 3p\ \ ^4D^\circ$ $3p\ ^2S^\circ\quad 3p\ \ ^2P^\circ\quad 3p\ \ ^2D^\circ$		
$2s^2\,2p^4(^1D)nx'$			$3,\,4s'\ ^2D$	$3p'\ ^2P^\circ\quad 3p'\ ^2D^\circ\quad 3p'\ ^2F^\circ$		
$2s^2\,2p^4(^1S)nx''$	$3s''\ ^2S$			$3p''\ ^2P^\circ$		
	$nd\ (n\geq 3)$			$nf\ (n\geq 4)$		
$2s^2\,2p^4(^3P)nx$	$\left\{\begin{array}{l}3d\ ^4P\qquad 3d\ \ ^4D\quad 3d\ ^4F\\3,\,4d\ ^2P\quad 3,\,4d\ ^2D\quad 3d\ ^2F\end{array}\right.$			$4f\ ^4D^\circ\quad 4f\ ^4F^\circ\quad 4f\ ^4G^\circ$ $4f\ ^2D^\circ$		
$2s^2\,2p^4(^1D)nx'$	$3d'\ ^2S$	$3d'\ ^2P$	$3d'\ ^2D\quad 3d'\ ^2F\quad 3d'\ ^2G$			
$2s^2\,2p^4(^1S)nx''$			$3d''\ ^2D$			

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

Ne III

(O I sequence; 8 electrons) $Z=10$

Ground state $1s^2\,2s^2\,2p^4\,{}^3P_2$

$2p^4\,{}^3P_2$ **514148** cm^{-1} I. P. 64 ± 1 volts

This spectrum is incompletely analyzed.   The terms have been taken from two references: triplet and quintet terms, de Bruin (1935); and singlet terms, Boyce (1934).   The latter are located with respect to the ground state by means of the nebular lines at 3343 A, 3868.74 A, and 3967.51 A. The relative positions of the quintet terms and the ionization potential are estimated, and the uncertainty, x, may be considerable.

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J. C. Boyce, Mon. Not. Roy. Astr. Soc. **96,** 690 (1936).   (C L)

Ne III   Ne III

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$2s^2\,2p^4$	$2p^4\;{}^3P$	2	0	-650	$2s^2\,2p^3({}^4S^\circ)3d$	$3d\;\;{}^3D^\circ$	1	*398192. 70*	
		1	650	-277			2	*398196. 83*	4. 13
		0	927				3	*398210. 74*	13. 91
$2s^2\,2p^4$	$2p^4\;{}^1D$	2	25841		$2s^2\,2p^3({}^4S^\circ)3d$	$3d\;\;{}^5D^\circ$	4	*398946. 98*$+x$	
							3	*398948. 51*$+x$	$-1. 53$
$2s^2\,2p^4$	$2p^4\;{}^1S$	0	55747				2	*398952. 34*$+x$	$-3. 83$
							1	*398955. 75*$+x$	$-3. 41$
$2s\;\,2p^5$	$2p^5\;{}^3P^\circ$	2	*204292*	-587			0		
		1	*204879*	-325					
		0	*205204*		$2s^2\,2p^3({}^2D^\circ)3p$	$3p'\;\;{}^3P$	2	398986. 64	$-95. 93$
$2s\;\,2p^5$	$2p^5\;{}^1P^\circ$	1	*289479*				1	399082. 57	$-42. 55$
							0	399125. 12	
$2s^2\,2p^3({}^4S^\circ)3s$	$3s\;\;{}^5S^\circ$	2	*314148* $+x$		$2s^2\,2p^3({}^2P^\circ)3p$	$3p''\;{}^3D$	3	409847. 53	
$2s^2\,2p^3({}^4S^\circ)3s$	$3s\;\;{}^3S^\circ$	1	*319444. 90*				2	409845. 08	2. 45
							1	409855. 23	$-10. 15$
$2s^2\,2p^3({}^4S^\circ)3p$	$3p\;\;{}^5P$	1	352662. 05$+x$	30. 88	$2s^2\,2p^3({}^2P^\circ)3p$	$3p''\;{}^3S$	1	410134. 72	
		2	352692. 93$+x$	52. 98					
		3	352745. 91$+x$		$2s^2\,2p^3({}^2P^\circ)3p$	$3p''\;{}^3P$	0	412293. 59	19. 52
$2s^2\,2p^3({}^2D^\circ)3s$	$3s'\;\;{}^3D^\circ$	3	*353148. 00*	$-29. 16$			1	412313. 11	7. 10
		2	*353177. 16*	$-20. 24$			2	412320. 21	
		1	*353197. 40*		$2s^2\,2p^3({}^2D^\circ)3d$	$3d'\;\;{}^3F^\circ$	2	*435527. 90*	
$2s^2\,2p^3({}^4S^\circ)3p$	$3p\;\;{}^3P$	2	356776. 52	10. 32			3	*435568. 00*	40. 10
		1	356766. 20	$-10. 32$			4	*435620. 80*	52. 80
		0	356776. 52		$2s^2\,2p^3({}^2D^\circ)3d$	$3d'\;\;{}^3G^\circ$	5	436561. 35	
$2s^2\,2p^3({}^2D^\circ)3s$	$3s'\;\;{}^1D^\circ$	2	*357930*				4	436588. 34	$-26. 99$
							3	436611. 56	$-23. 22$
$2s^2\,2p^3({}^2P^\circ)3s$	$3s''\;{}^3P^\circ$	2	*374434. 00*	$-26. 75$	$2s^2\,2p^3({}^2D^\circ)3d$	$3d'\;\;{}^3D^\circ$	3	*436844. 63*	
		1	*374460. 75*	$-16. 91$			2	*436914. 39*	$-69. 76$
		0	*374477. 66*				1	*436959. 49*	$-45. 10$
$2s^2\,2p^3({}^2P^\circ)3s$	$3s''\;{}^1P^\circ$	1	*379834*		$2s^2\,2p^3({}^2D^\circ)3d$	$3d'\;\;{}^3P^\circ$	2	*439586. 00*	$-121. 81$
$2s^2\,2p^3({}^2D^\circ)3p$	$3p'\;\;{}^3D$	1	389058. 24	11. 13			1	*439707. 81*	$-52. 54$
		2	389069. 37	69. 68			0	*439760. 35*	
		3	389139. 05		$2s^2\,2p^3({}^2D^\circ)3d$	$3d'\;\;{}^3S^\circ$	1	*440064. 90*	
$2s^2\,2p^3({}^2D^\circ)3p$	$3p'\;\;{}^3F$	2	391414. 02	15. 92					
		3	391429. 94	20. 37	Ne IV ($^4S^\circ_{1\frac12}$)	*Limit*		**514148**	
		4	391450. 31						

February 1947.

Ne III Observed Terms*

Config. $1s^2+$	Observed Terms					

Config. $1s^2+$	Observed Terms					
$2s^2\,2p^4$	$\{$ $2p^4\ ^1S$	$2p^4\ ^3P$		$2p^4\ ^1D$		
$2s\ 2p^5$	$\{$	$2p^5\ ^3P^\circ$ $2p^5\ ^1P^\circ$				

	$ns\ (n \geq 3)$			$np\ (n \geq 3)$		
$2s^2\,2p^3(^4S^\circ)nx$	$\{$ $3s\ ^5S^\circ$ $3s\ ^3S^\circ$				$3p\ ^5P$ $3p\ ^3P$	
$2s^2\,2p^3(^2D^\circ)nx'$	$\{$		$3s'\ ^3D^\circ$ $3s'\ ^1D^\circ$	$3p'\ ^3P$	$3p'\ ^3D$	$3p'\ ^3F$
$2s^2\,2p^3(^2P^\circ)nx''$	$\{$	$3s''\ ^3P^\circ$ $3s''\ ^1P^\circ$		$3p''\ ^3S$	$3p''\ ^3P$	$3p''\ ^3D$

	$nd\ (n \geq 3)$					
$2s^2\,2p^3(^4S^\circ)nx$			$3d\ ^5D^\circ$ $3d\ ^3D^\circ$			
$2s^2\,2p^3(^2D^\circ)nx'$	$3d'\ ^3S^\circ$	$3d'\ ^3P^\circ$	$3d'\ ^3D^\circ$	$3d'\ ^3F^\circ$	$3d'\ ^3G^\circ$	

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

Ne IV

(N I sequence; 7 electrons) $Z=10$

Ground state $1s^2\,2s^2\,2p^3\ ^4S^\circ_{1\frac{1}{2}}$

$2p^3\ ^4S^\circ_{1\frac{1}{2}}\ \boldsymbol{783880}$ cm^{-1} I. P. 97.16 volts

The analysis is by Paul and Polster, who have extended the earlier work by Boyce and published 111 classified lines in the interval from 140 A to 786 A. From series they derive the limit 781714 cm^{-1} and place the level $2p^3\ ^2D^\circ_2$ at 38540 cm^{-1} above the ground state zero. No intersystem combinations have been observed.

On the basis of later analyses of the spectra in this sequence a slight adjustment in these values has been made by Robinson. The doublet terms have been increased by 2410 cm^{-1} and the limit by 2166 cm^{-1} to fit the isoelectronic sequence data. The later values have been adopted in the table. The uncertainty x, may be considerable.

REFERENCES

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H. A. Robinson, unpublished material (March 1948). (I P) (T)

Config.	Desig.	J	Level	Interval
$2s^2\,2p^3$	$2p^3$ $^4S^\circ$	1½	*0*	
$2s^2\,2p^3$	$2p^3$ $^2D^\circ$	2½ 1½	*40950+x* *40975+x*	−25
$2s^2\,2p^3$	$2p^3$ $^2P^\circ$	½ 1½	*62157+x* *62167+x*	10
$2s\,2p^4$	$2p^4$ ^4P	2½ 1½ ½	183860 184477 184799	−617 −322
$2s\,2p^4$	$2p^4$ ^2D	2½ 1½	*253807+x* *253823+x*	−16
$2s\,2p^4$	$2p^4$ ^2S	½	*299351+x*	
$2s\,2p^4$	$2p^4$ ^2P	1½ ½	*319751+x* *320452+x*	−701
$2s^2\,2p^2(^3P)3s$	$3s$ ^4P	½ 1½ 2½	478701 479079 479651	378 572
$2p^5$	$2p^5$ $^2P^\circ$	1½ ½	*484623+x* *485585+x*	−962
$2s^2\,2p^2(^3P)3s$	$3s$ ^2P	½ 1½	*488215+x* *488917+x*	702
$2s^2\,2p^2(^1D)3s$	$3s'$ ^2D	{ 2½ 1½ }	*511411+x*	
$2s^2\,2p^2(^3P)3p$	$3p$ $^4P^\circ$	½ 1½ 2½	*524391* *524676* *525017*	285 341
$2s^2\,2p^2(^3P)3p$	$3p$ $^4S^\circ$	1½	*532978*	
$2s^2\,2p^2(^1S)3s$	$3s''$ ^2S	½	*551712+x*	
$2s^2\,2p^2(^3P)3d$	$3d$ ^2P	1½ ½	*575968+x* *576353+x*	−385
$2s^2\,2p^2(^1S)3d$	$3d''$ ^2D	{ 1½ 2½ }	*576915+x*	
$2s^2\,2p^2(^3P)3d$	$3d$ ^4P	2½ 1½ ½	579307 579626 579737	−319 −111
$2s^2\,2p^2(^3P)3d$	$3d$ ^2F	2½ 3½	*579375+x* *580095+x*	720
$2s^2\,2p^2(^3P)3d$	$3d$ ^2D	1½ 2½	*586685+x* *586918+x*	233
$2s\,2p^3(^5S^\circ)3s$	$3s'''$ $^4S^\circ$	1½	*588021*	
$2s^2\,2p^2(^1D)3d$	$3d'$ ^2F	{ 2½ 3½ }	*605417+x*	
$2s^2\,2p^2(^1D)3d$	$3d'$ ^2D	{ 1½ 2½ }	*609118+x*	
$2s^2\,2p^2(^1D)3d$	$3d'$ ^2P	½ 1½	*612668+x* *612781+x*	113
$2s^2\,2p^2(^1D)3d$	$3d'$ ^2S	½	*616482+x*	
$2s^2\,2p^2(^3P)4s$	$4s$ ^4P	½ 1½ 2½	633465 633790 634413	325 623
$2s^2\,2p^2(^3P)4s$	$4s$ ^2P	½ 1½	*635866+x* *636475+x*	609
$2s^2\,2p^2(^3P)4p$	$4p$ $^4D^\circ$	½ 1½ 2½ 3½	*641908* *642184* *642472* *642934*	276 288 462
$2s^2\,2p^2(^3P)4p$	$4p$ $^4P^\circ$	½ 1½ 2½	*643239* *643672* *643975*	433 303
$2s^2\,2p^2(^3P)4p$	$4p$ $^4S^\circ$	1½	*648060*	
$2s^2\,2p^2(^1D)4s$	$4s'$ ^2D	{ 2½ 1½ }	*664124+x*	
$2s^2\,2p^2(^3P)4d$	$4d$ ^2F	2½ 3½	*670595+x* *671252+x*	657
$2s^2\,2p^2(^3P)4d$	$4d$ ^4P	2½ 1½ ½	671402 672102 672676	−700 −574
$2s\,2p^3(^5S^\circ)3d$	$3d'''$ $^4D^\circ$	{ ½ to 3½ }	*672799*	
$2s^2\,2p^2(^3P)4d$	$4d$ ^2D	1½ 2½	*673427+x* *673587+x*	160
$2s^2\,2p^2(^3P)5s$	$5s$ ^4P	½ 1½ 2½	693106 693717 694353	611 636
$2s^2\,2p^2(^1D)4d$	$4d'$ ^2F	{ 2½ 3½ }	*697855+x*	
$2s^2\,2p^2(^1D)4d$	$4d'$ ^2D	{ 1½ 2½ }	*699622+x*	
$2s^2\,2p^2(^1D)4d$	$4d'$ ^2P	{ ½ 1½ }	*701223+x*	
$2s^2\,2p^2(^1S)4d$	$4d''$ ^2D	{ 1½ 2½ }	*709460+x*	
$2s^2\,2p^2(^1D)5s$	$5s'$ ^2D	{ 1½ 2½ }	*724690+x*	
$2s^2\,2p^2(^1D)5d$	$5d'$ ^2F	{ 2½ 3½ }	*740607+x*	
$2s^2\,2p^2(^1D)6s$	$6s'$ ^2D	{ 1½ 2½ }	*754597+x*	
Ne v ($^3P_0$)	**Limit**	--------		**783880**

March 1948.

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^3$	$\begin{cases}2p^3\ {}^4S° \\ \end{cases}$ $2p^3\ {}^2P°$ $2p^3\ {}^2D°$		
$2s\,\,2p^4$	$\begin{cases} \\ 2p^4\ {}^2S\end{cases}$ $\begin{matrix}2p^4\ {}^4P\\2p^4\ {}^2P\end{matrix}$ $2p^4\ {}^2D$		
$2p^5$	$2p^5\ {}^2P°$		

	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\,2p^2({}^3P)nx$	$\begin{matrix}3\text{–}5s\ {}^4P\\3,4s\ {}^2P\end{matrix}$	$3,4p\ {}^4S°$ $\quad$ $3,4p\ {}^4P°$ $\quad$ $4p\ {}^4D°$	$\begin{matrix}3,4d\ {}^4P\\3d\ {}^2P\end{matrix}$ $3,4d\ {}^2D$ $\quad$ $3,4d\ {}^2F$
$2s^2\,2p^2({}^1D)nx'$	$3\text{–}6s'\ {}^2D$		$3d'\ {}^2S$ $\quad$ $3,4d'\ {}^2P$ $\quad$ $3,4d'\ {}^2D$ $\quad$ $3\text{–}5d'\ {}^2F$
$2s^2\,2p^2({}^1S)nx''$	$3s''\ {}^2S$		$3,4d''\ {}^2D$
$2s\,\,2p^3({}^5S°)nx'''$	$3s'''\ {}^4S°$		$3d'''\ {}^4D°$

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

Ne V

(C I sequence; 6 electrons) $\hspace{8cm}$ $Z=10$

Ground state $1s^2\,2s^2\,2p^2\ {}^3P_0$

$2p^2\ {}^3P_0\ \mathbf{1019950}$ cm⁻¹ $\hspace{6cm}$ I. P. 126.4 volts

Paul and Polster have classified a total of 56 lines of Ne V in the range 118 A to 572 A, as transitions among 47 energy levels. The absolute value of $2p^2\ {}^3P_0$ is calculated from the $nd\ {}^3P°$ and $nd\ {}^3D°$ series, in each of which two members have been observed.

The singlet and triplet terms are connected by the intersystem lines $2p^2\ {}^3P_{2,1}-2p^2\ {}^1D_2$ observed in the spectra of gaseous nebula, as given by Bowen.

No intersystem combinations connecting the quintet terms with the rest have been observed, as indicated by the uncertainty x in the table. Paul and Polster estimate from isoelectronic sequence data that the term $2p^3\ {}^5S_2°$ is 86700 ± 300 cm⁻¹ above the ground state. From later data on this sequence Robinson places the value at 88842 cm⁻¹. The later value is entered in brackets and has been used in the present compilation for all quintet terms.

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H. A. Robinson, unpublished material (March 1948). (T)

Ne V   Ne V

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$2s^2\ 2p^2$	$2p^2\ ^3P$	0 1 2	0 414 1112	414 698	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1 2 3	698231 698382 698735	151 353
$2s^2\ 2p^2$	$2p^2\ ^1D$	2	30294		$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2 1 0	701765 702074 702459	−309 −385
$2s^2\ 2p^2$	$2p^2\ ^1S$	0	63900						
$2s\ 2p^3$	$2p^3\ ^5S^\circ$	2	[88842]+x		$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1P^\circ$	1	702412	
$2s\ 2p^3$	$2p^3\ ^3D^\circ$	3 2 1	175834 175905 175927	−71 −22	$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	709956	
$2s\ 2p^3$	$2p^3\ ^3P^\circ$	2, 1 0	208157 208193	−36	$2s\ 2p^2(^4P)3s$	$3s\ ^3P$	0 1 2	719350 719527 720011	177 484
$2s\ 2p^3$	$2p^3\ ^1D^\circ$	2	270564		$2s^2\ 2p(^2P^\circ)4s$	$4s\ ^3P^\circ$	0, 1, 2	795279	
$2s\ 2p^3$	$2p^3\ ^3S^\circ$	1	279365		$2s\ 2p^2(^4P)3d$	$3d\ ^5P$	3 2 1	799115+x 799286+x 799493+x	−171 −207
$2s\ 2p^3$	$2p^3\ ^1P^\circ$	1	303812						
$2p^4$	$2p^4\ ^3P$	2 1 0	412681 413466 413803	−785 −337	$2s^2\ 2p(^2P^\circ)4s$	$4s\ ^1P^\circ$	1	805284	
					$2s\ 2p^2(^4P)4s$	$4s\ ^5P$	1, 2, 3	822976+x	
$2s^2\ 2p(^2P^\circ)3s$	$3s\ ^3P^\circ$	0 1 2	596230 596626 597492	396 866	$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1D^\circ$	2	838623	
					$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3D^\circ$	1, 2, 3	842020	
$2s^2\ 2p(^2P^\circ)3s$	$3s\ ^1P^\circ$	1	605231		$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^3P^\circ$	2, 1, 0	842914	
$2s^2\ 2p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	690691		$2s^2\ 2p(^2P^\circ)4d$	$4d\ ^1F^\circ$	3	847207?	
$2s\ 2p^2(^4P)3s$	$3s\ ^5P$	1 2 3	697507+x 698059+x 698512+x	552 453	$2s\ 2p^2(^4P)4d$	$4d\ ^5P$	3, 2, 1	865282+x	
					Ne VI $(^2P^\circ_{1/2})$	Limit	-------	**1019950**	

March 1948.

Ne V Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\ 2p^2$	$\begin{cases} 2p^2\ ^1S \end{cases}$ $\quad 2p^2\ ^3P \qquad 2p^2\ ^1D$		
$2s\ 2p^3$	$\begin{cases} 2p^3\ ^5S^\circ \\ 2p^3\ ^3S^\circ \end{cases}$ $\quad 2p^3\ ^3P^\circ \quad 2p^3\ ^3D^\circ$ $\qquad\qquad 2p^3\ ^1P^\circ \quad 2p^3\ ^1D^\circ$		
$2p^4$	$2p^4\ ^3P$		
	$ns\ (n \geq 3)$	$nd\ (n \geq 3)$	
$2s^2\ 2p(^2P^\circ)nx$	$\begin{cases} 3, 4s\ ^3P^\circ \\ 3, 4s\ ^1P^\circ \end{cases}$	3, 4d ³P° 3, 4d ³D° 3d ¹P° 3, 4d ¹D° 3, 4d ¹F°	
$2s\ 2p^2(^4P)nx$	$\begin{cases} 3, 4s\ ^5P \\ 3s\ ^3P \end{cases}$	3, 4d ⁵P	

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

Ne VI

(B I sequence; 5 electrons) $Z=10$

Ground state $1s^2\,2s^2\,2p\,{}^2P^\circ_{1/2}$

$2p\,{}^2P^\circ_{1/2}$ **1274000±1000** cm⁻¹   I. P. 157.91±0.12 volts

This spectrum is incompletely analyzed.   Paul and Polster have classified 23 lines in the range from 110 A to 562 A.   They have estimated the limit and ionization potential from isoelectronic data.   No intersystem combinations have been observed but the uncertainty x is approximately known from their estimated value of $2p^2\,{}^4P$ (entered in brackets in the table).

REFERENCE

F. W. Paul and H. D. Polster, Phys. Rev. **59,** 429 (1941).   (I P) (T) (C L)

Ne VI   Ne VI

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$2s^2({}^1S)2p$	$2p\ {}^2P^\circ$	½ 1½	*0* *1316*	1316	$2s\,2p({}^3P^\circ)3s$	$3s\ \ {}^4P^\circ$	½ to 2½	*834113+x*	
$2s\,2p^2$	$2p^2\ {}^4P$	½ to 2½	[99300]+x		$2s\,2p({}^3P^\circ)3p$	$3p\ {}^2P$	½ 1½	878852	
$2s\,2p^2$	$2p^2\ {}^2D$	2½ 1½	178998 179020	−22	$2s\,2p({}^3P^\circ)3p$	$3p\ {}^2S$	½	900408	
$2s\,2p^2$	$2p^2\ {}^2S$	½	232587		$2s\,2p({}^3P^\circ)3p$	$3p\ {}^2D$	1½ 2½	906373	
$2s\,2p^2$	$2p^2\ {}^2P$	½ 1½	249292 250112	820	$2s\,2p({}^3P^\circ)3d$	$3d\ \ {}^4D^\circ$	½ to 3½	*924791±x*	
$2s^2({}^1S)3s$	$3s\ \ {}^2S$	½	722610						
$2s^2({}^1S)3p$	$3p\ {}^2P^\circ$	½ 1½	*763096* *763385*	289	Ne VII (${}^1S_0$)	*Limit*		**1274000**	
$2s^2({}^1S)3d$	$3d\ {}^2D$	1½ 2½	816405						

October 1946

SODIUM

Na I

11 electrons $Z=11$

Ground state $1s^2\,2s^2\,2p^6\,3s\,{}^2S_{1/2}$

$3s\,{}^2S_{1/2}$ **41449.65** cm^{-1} I. P. 5.138 volts

Thackeray has observed the ${}^2P°$ series in absorption to $n=73$. His values are used for this series for $n=4$ to 59,* and for the ${}^2D$ series for $n=8$ to 13.

Meissner and Luft have observed selected lines with an interferometer. Their results, including observed intervals of the 3–$6d\,{}^2D$ terms (the four-place entries in the table) and improved absolute values of the 3–$7s\,{}^2S$, $3p\,{}^2P°$ and 3–$7d\,{}^2D$ terms, have been used.

From infrared observations Rood and Sawyer have extended the $nf\,{}^2F°$ series from $n=5$ to $n=11$, except for $n=8$. Their values have been used, a calculated value of $8f\,{}^2F°$ being entered in brackets in the table.

The rest of the terms are from Fowler and Paschen-Götze, who published detailed analyses. By analogy with other spectra the designations $5g\,{}^2G$ and $6h\,{}^2H°$ have been assigned to the terms calculated from Fowler's combinations labeled "3ϕ–4ϕ" and "4ϕ–5ϕ", respectively.

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E. R. Thackeray, Phys. Rev. (1949). (In press). (I P) (T) (C L)

Na I

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s$	$3s\ {}^2S$	½	0. 000		$5p$	$5p\ {}^2P°$	½ 1½	*35040. 27* *35042. 79*	2. 52
$3p$	$3p\ {}^2P°$	½ 1½	*16956. 183* *16973. 379*	17. 1963	$6s$	$6s\ {}^2S$	½	36372. 647	
$4s$	$4s\ {}^2S$	½	25739. 86		$5d$	$5d\ {}^2D$	2½ 1½	37036. 781 37036. 805	−0. 0230
$3d$	$3d\ {}^2D$	2½ 1½	29172. 855 29172. 904	−0. 0494	$5f$	$5f\ {}^2F°$	{ 2½ 3½ }	*37057. 6*	
$4p$	$4p\ {}^2P°$	½ 1½	*30266. 88* *30272. 51*	5. 63	$5g$	$5g\ {}^2G$	{ 3½ 4½ }	37060. 2	
$5s$	$5s\ {}^2S$	½	33200. 696		$6p$	$6p\ {}^2P°$	½ 1½	*37296. 51* *37297. 76*	1. 25
$4d$	$4d\ {}^2D$	2½ 1½	34548. 754 34548. 789	−0. 0346	$7s$	$7s\ {}^2S$	½	38012. 074	
$4f$	$4f\ {}^2F°$	{ 2½ 3½ }	*34588. 6*		$6d$	$6d\ {}^2D$	2½ 1½	38387. 287 38387. 300	=0. 0124

*The last 14 members are not included because page proof had been prepared when the data were received.

Config.	Desig.	J	Level	Interval
6f	6f ²F°	{ 2½ 3½ }	38400. 1	
6h	6h ²H°	{ 4½ 5½ }	38403. 4	
7p	7p ²P°	½ 1½	38540. 40 38541. 14	0. 74
8s	8s ²S	½	38968. 35	
7d	7d ²D	2½ 1½	39200. 962 39200. 963	−0. 001
7f	7f ²F°	{ 2½ 3½ }	39209. 2	
8p	8p ²P°	½ 1½	39298. 54 39299. 01	0. 47
9s	9s ²S	½	39574. 51	
8d	8d ²D	{ 2½ 1½ }	39729. 00	
8f	8f ²F°	{ 2½ 3½ }	[39734. 0]	
9p	9p ²P°	½ 1½	39794. 53 39795. 00	0. 47
10s	10s ²S	½	39983. 0	
9d	9d ²D	{ 2½ 1½ }	40090. 57	
9f	9f ²F°	{ 2½ 3½ }	40093. 2	
10p	10p ²P°	{ ½ 1½ }	40137. 23	
11s	11s ²S	½	40273. 5	
10d	10d ²D	{ 2½ 1½ }	40349. 17	
10f	10f ²F°	{ 2½ 3½ }	40350. 9	
11p	11p ²P°	{ ½ 1½ }	40383. 16	
12s	12s ²S	½	40482. 9	
11f	11f ²F°	{ 2½ 3½ }	40539	
11d	11d ²D	{ 2½ 1½ }	40540. 35	
12p	12p ²P°	{ ½ 1½ }	40566. 03	
13s	13s ²S	½	40644. 6	
12d	12d ²D	{ 2½ 1½ }	40685. 8	
13p	13p ²P°	{ ½ 1½ }	40705. 68	
14s	14s ²S	½	40769. 5	
13d	13d ²D	{ 2½ 1½ }	40798. 8	

Config.	Desig.	J	Level	Interval
14p	14p ²P°	{ ½ 1½ }	40814. 47	
14d	14d ²D	{ 2½ 1½ }	40890. 0	
15p	15p ²P°	{ ½ 1½ }	40901. 11	
15d	15d ²D	{ 2½ 1½ }	40958	
16p	16p ²P°	{ ½ 1½ }	40971. 16	
17p	17p ²P°	{ ½ 1½ }	41028. 68	
18p	18p ²P°	{ ½ 1½ }	41076. 37	
19p	19p ²P°	{ ½ 1½ }	41116. 28	
20p	20p ²P°	{ ½ 1½ }	41150. 39	
21p	21p ²P°	{ ½ 1½ }	41179. 22	
22p	22p ²P°	{ ½ 1½ }	41204. 28	
23p	23p ²P°	{ ½ 1½ }	41225. 88	
24p	24p ²P°	{ ½ 1½ }	41244. 77	
25p	25p ²P°	{ ½ 1½ }	41261. 42	
26p	26p ²P°	{ ½ 1½ }	41276. 11	
27p	27p ²P°	{ ½ 1½ }	41289. 16	
28p	28p ²P°	{ ½ 1½ }	41300. 74	
29p	29p ²P°	{ ½ 1½ }	41311. 09	
30p	30p ²P°	{ ½ 1½ }	41320. 34	
31p	31p ²P°	{ ½ 1½ }	41328. 87	
32p	32p ²P°	{ ½ 1½ }	41336. 50	
33p	33p ²P°	{ ½ 1½ }	41343. 49	
34p	34p ²P°	{ ½ 1½ }	41349. 70	
35p	35p ²P°	{ ½ 1½ }	41355. 50	
36p	36p ²P°	{ ½ 1½ }	41360. 82	

Config.	Desig.	J	Level	Interval
37p	37p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41365.66	
38p	38p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41370.11	
39p	39p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41374.27	
40p	40p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41378.04	
41p	41p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41381.55	
42p	42p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41384.84	
43p	43p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41387.91	
44p	44p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41390.73	
45p	45p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41393.84	
46p	46p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41395.77	
47p	47p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41398.10	
48p	48p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41400.28	

Config.	Desig.	J	Level	Interval
49p	49p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41402.25	
50p	50p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41404.18	
51p	51p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41406.03	
52p	52p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41407.69	
53p	53p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41409.30	
54p	54p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41410.81	
55p	55p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41412.20	
56p	56p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41413.59	
57p	57p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41414.89	
58p	58p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41416.06	
59p	59p ^{2}P°	$\begin{cases} \tfrac{1}{2} \\ 1\tfrac{1}{2} \end{cases}$	41417.18	
Na II (^{1}S$_0$)	*Limit*		41449.65	

January 1949.

Na II

(Ne I sequence; 10 electrons) $Z=11$

Ground state $1s^2\,2s^2\,2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ **381528** cm^{-1} I. P. 47.29 volts

The analysis has been taken from Söderqvist's Monograph except for the 5s- and 6s-levels, which are quoted from Vance's paper.

The term designations assigned by Söderqvist on the assumption of LS-coupling are listed under the heading "Author," with corresponding assignments added for the 5s- and 6s-levels.

As for Ne I, the jl-coupling notation in the general form suggested by Racah is adopted. Shortley has, however, pointed out that the configurations $2p^5\,3s$, $2p^5\,3p$, and $2p^5\,3d$ are much closer to LS-coupling than they are to jl-coupling.

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Na II

Author	Config.	Desig.	J	Level
2p ¹S₀	2p⁶	2p⁶ ¹S	0	0.00
3s₅ ³P₂	2p⁵(²P°₁½)3s	3s [1½]°	2	264928.00
3s₄ ³P₁			1	265693.29
3s₃ ³P₀	2p⁵(²P°½)3s	3s' [½]°	0	266285.36
3s₂ ¹P₁			1	268766.67
3p₁₀ ³S₁	2p⁵(²P°₁½)3p	3p [½]	1	293224.12
3p₉ ³D₃	''	3p [2½]	3	297252.52
3p₈ ³D₂			2	297639.34
3p₇ ³D₁	''	3p [1½]	1	298169.14
3p₆ ¹D₂			2	299193.75
3p₃ ³P₀	''	3p [½]	0	300391.59
3p₅ ¹P₁	2p⁵(²P°½)3p	3p' [1½]	1	299889.16
3p₄ ³P₂			2	300107.71
3p₂ ³P₁	''	3p' [½]	1	300510.92
3p₁ ¹S₀			0	308864.54
3d ³P₀ / ³P₁	2p⁵(²P°₁½)3d	3d [½]°	0 / 1	330553.18 / 330640.60
3d ³P₂	''	3d [1½]°	2	330792.85
3d ³F₄ / ³F₃	''	3d [3½]°	4 / 3	331126.76 / 331190.49
3d ³F₂ / ¹F₃	''	3d [2½]°	2 / 3	331669.40 / 331711.75

Author	Config.	Desig.	J	Level
3d ¹P₁	2p⁵(²P°₁½)3d	3d [1½]°	1	331748.77
3d ¹D₂ / ³D₃	2p⁵(²P°½)3d	3d' [2½]°	2 / 3	332806.06 / 332845.80
3d ³D₂ / ³D₁	''	3d' [1½]°	2 / 1	332966.42 / 333166.70
4s₅ ³P₂ / 4s₄ ³P₁	2p⁵(²P°₁½)4s	4s [1½]°	2 / 1	331500.29 / 331877.67
4s₃ ³P₀ / 4s₂ ¹P₁	2p⁵(²P°½)4s	4s' [½]°	0 / 1	332713.96 / 333111.60
5s₄ ³P₁	2p⁵(²P°₁½)5s	5s [1½]°	2 / 1	353260
5s₂ ¹P₁	2p⁵(²P°½)5s	5s' [½]°	0 / 1	354850
4d ¹P₁	2p⁵(²P°₁½)4d	4d [1½]°	1	353573
6s₄ ³P₁	2p⁵(²P°₁½)6s	6s [1½]°	2 / 1	363500
6s₂ ¹P₁	2p⁵(²P°½)6s	6s' [½]°	0 / 1	364960
Na III (²P°₁½)		Limit	-------	**381528**
Na III (²P°½)		Limit	-------	382892

August 1947.

Na II Observed Levels*

Config. 1s² 2s²+	Observed Terms		
2p⁶	2p⁶ ¹S		
	ns (n≥3)	np (n≥3)	nd (n≥3)
2p⁵(²P°)nx	{ 3–6s ³P° / 3–6s ¹P°	3p ³S 3p ³P 3p ³D / 3p ¹S 3p ¹P 3p ¹D	3d ³P° 3d ³D° 3d ³F° / 3, 4d ¹P° 3d ¹D° 3d ¹F°

jl-Coupling Notation

	Observed Pairs		
	ns (n≥3)	np (n≥3)	nd (n≥3)
2p⁵(²P°₁½)nx	3–6s [1½]°	3p [½] / 3p [2½] / 3p [1½]	3d [½]° / 3d [3½]° / 3, 4d [1½]° / 3d [2½]°
2p⁵(²P°½)nx'	3–6s' [½]°	3p' [1½] / 3p' [½]	3d' [2½]° / 3d' [1½]°

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

Na III

(F I sequence; 9 electrons) $Z=11$

Ground state is $1s^2\, 2s^2\, 2p^5\ ^2\mathrm{P}^{\circ}_{1\frac{1}{2}}$

$2p^5\ ^2\mathrm{P}^{\circ}_{1\frac{1}{2}}\ \mathit{578033}$ cm^{-1} I. P. 71.65 volts

The terms are taken from the paper by Tomboulian, who has revised and extended the analysis by Söderqvist, but adopts the limit estimated by Söderqvist. The $^2\mathrm{P}^{\circ}$ term from the $^1\mathrm{S}$ limit in Na IV has not been located to confirm Söderqvist's $^2\mathrm{S}$ and $^2\mathrm{D}$ terms from this limit. Intersystem combinations have been observed, connecting the doublet and quartet terms.

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D. H. Tomboulian, Phys. Rev. **54,** 347 (1938).   (I P) (T) (C L)

Na III

Config.	Desig.	J	Level	Interval
$2s^2\, 2p^5$	$2p^5\ ^2\mathrm{P}^{\circ}$	$1\frac{1}{2}$	0	-1364
		$\frac{1}{2}$	1364	
$2s\, 2p^6$	$2p^6\ ^2\mathrm{S}$	$\frac{1}{2}$	264449	
$2s^2\, 2p^4(^3\mathrm{P})3s$	$3s\ ^4\mathrm{P}$	$2\frac{1}{2}$	366165. 3	$-887.\,0$
		$1\frac{1}{2}$	367052. 3	$-509.\,6$
		$\frac{1}{2}$	367561. 9	
$2s^2\, 2p^4(^3\mathrm{P})3s$	$3s\ ^2\mathrm{P}$	$1\frac{1}{2}$	373633. 0	$-1048.\,4$
		$\frac{1}{2}$	374681. 4	
$2s^2\, 2p^4(^1\mathrm{D})3s$	$3s'\ ^2\mathrm{D}$	$2\frac{1}{2}$	399179. 4	$-3.\,3$
		$1\frac{1}{2}$	399182. 7	
$2s^2\, 2p^4(^3\mathrm{P})3p$	$3p\ ^4\mathrm{P}^{\circ}$	$2\frac{1}{2}$	$\mathit{406200.\,9}$	$-361.\,1$
		$1\frac{1}{2}$	$\mathit{406562.\,0}$	$-314.\,0$
		$\frac{1}{2}$	$\mathit{406876.\,0}$	
$2s^2\, 2p^4(^3\mathrm{P})3p$	$3p\ ^4\mathrm{D}^{\circ}$	$3\frac{1}{2}$	$\mathit{410987.\,9}$	$-560.\,3$
		$2\frac{1}{2}$	$\mathit{411548.\,2}$	$-415.\,7$
		$1\frac{1}{2}$	$\mathit{411963.\,9}$	$-237.\,6$
		$\frac{1}{2}$	$\mathit{412201.\,5}$	
$2s^2\, 2p^4(^3\mathrm{P})3p$	$3p\ ^2\mathrm{D}^{\circ}$	$2\frac{1}{2}$	$\mathit{414281.\,0}$	$-892.\,2$
		$1\frac{1}{2}$	$\mathit{415173.\,2}$	
$2s^2\, 2p^4(^3\mathrm{P})3p$	$3p\ ^2\mathrm{S}^{\circ}$	$\frac{1}{2}$	$\mathit{416910.\,2}$	

Na III

Config.	Desig.	J	Level	Interval
$2s^2\, 2p^4(^3\mathrm{P})3p$	$3p\ ^4\mathrm{S}^{\circ}$	$1\frac{1}{2}$	$\mathit{417415.\,5}$	
$2s^2\, 2p^4(^3\mathrm{P})3p$	$3p\ ^2\mathrm{P}^{\circ}$	$1\frac{1}{2}$	$\mathit{418418.\,1}$	$-138.\,8$
		$\frac{1}{2}$	$\mathit{418556.\,9}$	
$2s^2\, 2p^4(^1\mathrm{S})3s$	$3s''\ ^2\mathrm{S}$	$\frac{1}{2}$	435031	
$2s^2\, 2p^4(^1\mathrm{D})3p$	$3p'\ ^2\mathrm{F}^{\circ}$	$2\frac{1}{2}$	$\mathit{440472.\,0}$	80. 4
		$3\frac{1}{2}$	$\mathit{440552.\,4}$	
$2s^2\, 2p^4(^1\mathrm{D})3p$	$3p'\ ^2\mathrm{P}^{\circ}$	$1\frac{1}{2}$	$\mathit{442710.\,5}$	$-551.\,1$
		$\frac{1}{2}$	$\mathit{443261.\,6}$	
$2s^2\, 2p^4(^1\mathrm{D})3p$	$3p'\ ^2\mathrm{D}^{\circ}$	$1\frac{1}{2}$	$\mathit{444748.\,1}$	76. 9
		$2\frac{1}{2}$	$\mathit{444825.\,0}$	
$2s^2\, 2p^4(^3\mathrm{P})3d$	$3d\ ^4\mathrm{D}$	$3\frac{1}{2}$	$\mathit{460267.\,8}$	$-153.\,2$
		$2\frac{1}{2}$	$\mathit{460421.\,0}$	$-184.\,6$
		$1\frac{1}{2}$	$\mathit{460605.\,6}$	$-153.\,7$
		$\frac{1}{2}$	460759. 3	
$2s^2\, 2p^4(^3\mathrm{P})3d$	$3d\ ^4\mathrm{F}$	$4\frac{1}{2}$	$\mathit{461877.\,4?}$	$-1235.\,4$
		$3\frac{1}{2}$	$\mathit{463112.\,8}$	$-515.\,3$
		$2\frac{1}{2}$	$\mathit{463628.\,1}$	165. 9
		$1\frac{1}{2}$	$\mathit{463462.\,2}$	
$2s^2\, 2p^4(^3\mathrm{P})3d$	$3d\ ^4\mathrm{P}$	$\frac{1}{2}$	$\mathit{462391.\,2}$	572. 4
		$1\frac{1}{2}$	$\mathit{462963.\,6}$	293. 8
		$2\frac{1}{2}$	$\mathit{463257.\,4}$	

Na III—Continued

Config.	Desig.	J	Level	Interval
$2s^2\,2p^4(^3P)3d$	$3d$ ^2F	3½ / 2½	463968. 8 / 465768. 8	−1800. 0
$2s^2\,2p^4(^3P)3d$	$3d$ ^2D	2½ / 1½	464392. 1 / 465027. 9	−635. 8
$2s^2\,2p^4(^3P)3d$	$3d$ ^2P	½ / 1½	465988. 0 / 466773. 0	785. 0
$2s^2\,2p^4(^3P)4s$	$4s$ ^4P	2½ / 1½ / ½	467773. 8 / 468528. 5 / 468949. 5	−754. 7 / −421. 0
$2s^2\,2p^4(^3P)4s$	$4s$ ^2P	1½ / ½	471446. 6 / 472250. 6	−804. 0
$2s^2\,2p^4(^1D)3d$	$3d'$ ^2G	4½ / 3½	491928. 2	
$2s^2\,2p^4(^1D)3d$	$3d'$ ^2P	½ / 1½	493191. 3 / 493289. 3	98. 0
$2s^2\,2p^4(^1D)3d$	$3d'$ ^2D	1½ / 2½	493853. 2 / 494599. 0	745. 8
$2s^2\,2p^4(^1D)3d$	$3d'$ ^2F	3½ / 2½	495446. 8 / 495668. 6	−221. 8

Na III—Continued

Config.	Desig.	J	Level	Interval
$2s^2\,2p^4(^1D)3d$	$3d'$ ^2S	½	497751. 2	
$2s^2\,2p^4(^1D)4s$	$4s'$ ^2D	2½ / 1½	511410	
$2s^2\,2p^4(^3P)4d$	$4d$ ^2D	2½ / 1½	514652	
$2s^2\,2p^4(^3P)4d$	$4d$ ^2P	½ / 1½	515023 / 515379	356
$2s^2\,2p^4(^1S)3d$	$3d''$ ^2D	2½ / 1½	529465 / 529498	−33
$2s^2\,2p^4(^1D)4d$	$4d'$ ^2P	{ ½ / 1½ }	544227	
$2s^2\,2p^4(^1D)4d$	$4d'$ ^2D	1½ / 2½	544736	
Na IV ($^3P_2$)	*Limit*	-------	*578033*	

March 1947.

Na III Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^5$	$2p^5$ $^2P°$		
$2s\,2p^6$	$2p^6$ ^2S		
	ns ($n\geq 3$)	np ($n\geq 3$)	nd ($n\geq 3$)
$2s^2\,2p^4(^3P)nx$	{ 3, 4s ^4P / 3, 4s ^2P	3p $^4S°$ 3p $^4P°$ 3p $^4D°$ / 3p $^2S°$ 3p $^2P°$ 3p $^2D°$	3d ^4P 3d ^4D 3d ^4F / 3, 4d ^2P 3, 4d ^2D 3d ^2F
$2s^2\,2p^4(^1D)nx'$	3, 4s' ^2D	3p' $^2P°$ 3p' $^2D°$ 3p' $^2F°$	3d' ^2S 3, 4d' ^2P 3, 4d' ^2D 3d' ^2F 3d' ^2G
$2s^2\,2p^4(^1S)nx''$	3s'' ^2S		3d'' ^2D

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

Na IV

(O I sequence; 8 electrons) $Z=11$

Ground state $1s^2\,2s^2\,2p^4\,{}^3P_2$

$2p^4\,{}^3P_2$ **797741** cm^{-1} I. P. 98.88 volts

The terms are from Söderqvist who has extended Vance's early work on this spectrum. In the 1946 reference Söderqvist states that the absolute values of the singlets as published in his Monograph should be decreased by 1000 cm^{-1}. This correction has been applied in the present list. The analysis is incomplete but 74 lines have been classified in the range 129 Å to 412 Å, and 40 terms found. No intersystem combinations have been observed and the uncertainty, x, may be considerable. The term $3d'''\ {}^3D$ has been calculated from its combination with $2p^5\,{}^3P°$ and added to the published list.

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J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **32A,** No. 19 p. 4 (1946). (C L)

Na IV

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$2s^2\,2p^4$	$2p^4$ ^{3}P	2 1 0	0 1106 1576	-1106 -470	$2s^2\,2p^3(^2$P°$)3d$	$3d''$ ^{3}P°	2, 1, 0	663592	
$2s^2\,2p^4$	$2p^4$ ^{1}D	2	31118+x		$2s^2\,2p^3(^2$P°$)3d$	$3d''$ ^{1}D°	2	664904+x	
$2s^2\,2p^4$	$2p^4$ ^{1}S	0	66780+x		$2s^2\,2p^3(^2$P°$)3d$	$3d''$ ^{3}D°	3, 2, 1	665362	
$2s\,2p^5$	$2p^5$ ^{3}P°	2 1 0	243682 244688 245238	-1006 -550	$2s^2\,2p^3(^2$P°$)3d$	$3d''$ ^{1}P°	1	665640+x	
					$2s^2\,2p^3(^2$P°$)3d$	$3d''$ ^{1}F°	3	667696+x	
$2s\,2p^5$	$2p^5$ ^{1}P°	1	343972+x		$2s^2\,2p^3(^4$S°$)4d$	$4d$ ^{3}D°	3, 2, 1	684649	
$2s^2\,2p^3(^4$S°$)3s$	$3s$ ^{3}S°	1	486648		$2s^2\,2p^3(^2$D°$)4s$	$4s'$ ^{3}D°	3, 2, 1	689755	
$2s^2\,2p^3(^2$D°$)3s$	$3s'$ ^{3}D°	3 2 1	525100 525119 525136	-19 -17	$2s^2\,2p^3(^2$D°$)4s$	$4s'$ ^{1}D°	2	692043+x	
					$2s^2\,2p^3(^2$P°$)4s$	$4s''$ ^{3}P°	2, 1, 0	714937	
$2s^2\,2p^3(^2$D°$)3s$	$3s'$ ^{1}D°	2	531696+x		$2s^2\,2p^3(^2$P°$)4s$	$4s''$ ^{1}P°	1	716773+x	
$2s^2\,2p^3(^2$P°$)3s$	$3s''$ ^{3}P°	2, 1, 0	550176		$2s^2\,2p^3(^2$D°$)4d$	$4d'$ ^{3}D°	3, 2, 1	730712	
$2s^2\,2p^3(^2$P°$)3s$	$3s''$ ^{1}P°	1	557081+x		$2s^2\,2p^3(^2$D°$)4d$	$4d'$ ^{1}P°	1	731948+x	
$2s^2\,2p^3(^4$S°$)3d$	$3d$ ^{3}D°	1 2 3	594893 594898 594941	5 43	$2s^2\,2p^3(^2$D°$)4d$	$4d'$ ^{3}P°	2, 1, 0	732355	
					$2s^2\,2p^3(^2$D°$)4d$	$4d'$ ^{3}S°	1	732940	
$2s^2\,2p^3(^2$D°$)3d$	$3d'$ ^{3}D°	3 2 1	638831 638942 638977	-111 -35	$2s^2\,2p^3(^2$D°$)4d$	$4d'$ ^{1}D°	2	733548+x	
					$2s^2\,2p^3(^2$D°$)4d$	$4d'$ ^{1}F°	3	734195+x	
$2s^2\,2p^3(^2$D°$)3d$	$3d'$ ^{1}P°	1	641468+x		$2s^2\,2p^3(^2$D°$)5s$	$5s'$ ^{3}D°	3, 2, 1	753352	
$2s^2\,2p^3(^2$D°$)3d$	$3d'$ ^{3}P°	2 1 0	643029 643304 (643396)	-275 (-92)	$2s^2\,2p^3(^2$P°$)4d$	$4d''$ ^{1}D°	2	756045+x	
					$2s^2\,2p^3(^2$P°$)4d$	$4d''$ ^{3}D°	3, 2, 1	756367	
					$2s^2\,2p^3(^2$P°$)4d$	$4d''$ ^{1}F°	3	757261+x	
$2s^2\,2p^3(^2$D°$)3d$	$3d'$ ^{1}D°	2	643912+x		$2s^2\,2p^3(^2$D°$)5d$	$5d'$ ^{3}D°	3, 2, 1	772415	
$2s^2\,2p^3(^2$D°$)3d$	$3d'$ ^{3}S°	1	644140						
$2s^2\,2p^3(^4$S°$)4s$	$4s$ ^{3}S°	1	644792		Na v (^{4}S$^\circ_{1½}$)	*Limit*		797741	
$2s^2\,2p^3(^2$D°$)3d$	$3d'$ ^{1}F°	3	646711+x		$2s\,2p^4(^4$P$)3d$	$3d'''$ ^{3}D	3, 2, 1	813538	

February 1947.

Config. $1s^2+$	Observed Terms					
$2s^2\,2p^4$	$\{$ $2p^4\,{}^1S$	$2p^4\,{}^3P$	$2p^4\,{}^1D$			
$2s\,2p^5$	$\{$ $2p^5\,{}^3P°$	$2p^5\,{}^1P°$				

Config. $1s^2+$	$ns\ (n\geq 3)$		$nd\ (n\geq 3)$			
$2s^2\,2p^3({}^4S°)nx$	$3,4s\ {}^3S°$				$3,4d\ {}^3D°$	
$2s^2\,2p^3({}^2D°)nx'$	$\{$	$3\text{–}5s'\ {}^3D°$ $3,4s'\ {}^1D°$	$3,4d'\ {}^3S°$	$3,4d'\ {}^3P°$ $3,4d'\ {}^1P°$	$3\text{–}5d'\ {}^3D°$ $3,4d'\ {}^1D°$	$3,4d'\ {}^1F°$
$2s^2\,2p^3({}^2P°)nx''$	$\{$ $3,4s''\ {}^3P°$ $3,4s''\ {}^1P°$			$3d''\ {}^3P°$ $3d''\ {}^1P°$	$3,4d''\ {}^3D°$ $3,4d''\ {}^1D°$	$3,4d''\ {}^1F°$
$2s\,2p^4({}^4P)nx'''$				$3d'''\ {}^3D$		

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

Na V

(N I sequence; 7 electrons) $\hspace{4cm}$ $Z=11$

Ground state $1s^2\,2s^2\,2p^3\ {}^4S°_{1\frac{1}{2}}$

$2p^3\ {}^4S°_{1\frac{1}{2}}$ *1118170* cm^{-1} $\hspace{4cm}$ I. P. 138.60 volts

Söderqvist has found 45 terms in this spectrum and classified 203 lines in the interval between 100 A and 514 A. No intersystem combinations have been observed. The series are short and the uncertainty, x, may be considerable.

REFERENCES

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J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **32A**, No. 19 p. 4 (1946). (I P) (T) (C L)

Na V

Author	Config.	Desig.	J	Level	Interval
$2p$ $^4S_2$	$2s^2\,2p^3$	$2p^3$ $^4S°$	$1\tfrac12$	*0*	
$2p$ $^2D_3$ $^2D_2$	$2s^2\,2p^3$	$2p^3$ $^2D°$	$2\tfrac12$ $1\tfrac12$	*47570+x* *47595+x*	*−25*
$2p$ $^2P_1$ $^2P_2$	$2s^2\,2p^3$	$2p^3$ $^2P°$	$\tfrac12$ $1\tfrac12$	*72454+x* *72493+x*	39
$2p'$ $^4P_3$ $^4P_2$ $^4P_1$	$2s\,2p^4$	$2p^4$ ^4P	$2\tfrac12$ $1\tfrac12$ $\tfrac12$	215860 216896 217440	−1036 −544
$2p'$ $^2D_3$ $^2D_2$	$2s\,2p^4$	$2p^4$ ^2D	$2\tfrac12$ $1\tfrac12$	*297116+x* *297150+x*	−34
$2p'$ $^2S_1$	$2s\,2p^4$	$2p^4$ ^2S	$\tfrac12$	*349987+x*	
$2p'$ $^2P_2$ $^2P_1$	$2s\,2p^4$	$2p^4$ ^2P	$1\tfrac12$ $\tfrac12$	*371967+x* *373167+x*	−1200
$2p''$ $^2P_2$ $^2P_1$	$2p^5$	$2p^5$ $^2P°$	$1\tfrac12$ $\tfrac12$	*567583+x* *569211+x*	−1628
$3s$ $^4P_1$ $^4P_2$ $^4P_3$	$2s^2\,2p^2(^3P)3s$	$3s$ ^4P	$\tfrac12$ $1\tfrac12$ $2\tfrac12$	671136 671790 672757	654 967
$3s$ $^2P_1$ $^2P_2$	$2s^2\,2p^2(^3P)3s$	$3s$ ^2P	$\tfrac12$ $1\tfrac12$	*682470+x* *683673+x*	1203
$\overline{3s}$ ^2D	$2s^2\,2p^2(^1D)3s$	$3s'$ ^2D	$\{2\tfrac12,\,1\tfrac12\}$	*709277+x*	
$\overline{\overline{3s}}$ $^2S_1$	$2s^2\,2p^2(^1S)3s$	$3s''$ ^2S	$\tfrac12$	*748640+x*	
$3d$ $^2P_2$ $^2P_1$	$2s^2\,2p^2(^3P)3d$	$3d$ ^2P	$1\tfrac12$ $\tfrac12$	*792337+x* *792849+x*	−512
$3d$ $^4D_{23}$ $^4D_1$	$2s^2\,2p^2(^3P)3d$	$3d$ ^4D	$\{3\tfrac12,\,2\tfrac12,\,1\tfrac12\}$ $\tfrac12$	797060 797270	−210
$3d$ $^2F_3$ $^2F_4$	$2s^2\,2p^2(^3P)3d$	$3d$ ^2F	$2\tfrac12$ $3\tfrac12$	*797288+x* *798535+x*	1247
$3d$ $^4P_3$ $^4P_2$ $^4P_1$	$2s^2\,2p^2(^3P)3d$	$3d$ ^4P	$2\tfrac12$ $1\tfrac12$ $\tfrac12$	798174 798620 798862	−446 −242
$3s'$ $^4S_2$	$2s\,2p^3(^5S°)3s$	$3s'''$ $^4S°$	$1\tfrac12$	*801950*	
$3d$ $^2D_2$ $^2D_3$	$2s^2\,2p^2(^3P)3d$	$3d$ ^2D	$1\tfrac12$ $2\tfrac12$	*808546+x* *808920+x*	374
$\overline{3d}$ $^2F_4$ $^2F_3$	$2s^2\,2p^2(^1D)3d$	$3d'$ ^2F	$3\tfrac12$ $2\tfrac12$	*828509+x* *828692+x*	−183
$\overline{3d}$ $^2D_2$ $^2D_3$	$2s^2\,2p^2(^1D)3d$	$3d'$ ^2D	$1\tfrac12$ $2\tfrac12$	*832075+x* *832228+x*	153
$\overline{3d}$ $^2P_1$ $^2P_2$	$2s^2\,2p^2(^1D)3d$	$3d'$ ^2P	$\tfrac12$ $1\tfrac12$	*837431+x* *837723+x*	292
$\overline{\overline{3d}}$ $^2S_1$	$2s^2\,2p^2(^1D)3d$	$3d'$ ^2S	$\tfrac12$	*842067+x*	
$3p'$ ^4P	$2s\,2p^3(^5S°)3p$	$3p'''\,^4P$	$\{\tfrac12 \text{ to } 2\tfrac12\}$	847539	
$\overline{\overline{3d}}$ ^2D	$2s^2\,2p^2(^1S)3d$	$3d''$ ^2D	$\{1\tfrac12 \text{ to } 2\tfrac12\}$	*866780+x*	

Author	Config.	Desig.	J	Level	Interval
$\overline{3s'}$ ^4D	$2s\,2p^3(^3D°)3s$	$3s^{IV}$ $^4D°$	$\{\tfrac12 \text{ to } 3\tfrac12\}$	*878288*	
$4s$ $^4P_1$ $^4P_2$ $^4P_3$	$2s^2\,2p^2(^3P)4s$	$4s$ ^4P	$\tfrac12$ $1\tfrac12$ $2\tfrac12$	892244 892885 893822	641 937
$\overline{3s'}$ ^2D	$2s\,2p^3(^3D°)3s$	$3s^{IV}$ $^2D°$	$\{1\tfrac12,\,2\tfrac12\}$	*894095+x*	
$4s$ $^2P_1$ $^2P_2$	$2s^2\,2p^2(^3P)4s$	$4s$ ^2P	$\tfrac12$ $1\tfrac12$	*895944+x* *897147+x*	1203
$3d'$ ^4D	$2s\,2p^3(^5S°)3d$	$3d'''\,^4D°$	$\{\tfrac12 \text{ to } 3\tfrac12\}$	*908717*	
$\overline{\overline{3s'}}$ ^4P	$2s\,2p^3(^3P°)3s$	$3s^V$ $^4P°$	$\{\tfrac12 \text{ to } 2\tfrac12\}$	*919070*	
$\overline{4s}$ ^2D	$2s^2\,2p^2(^1D)4s$	$4s'$ ^2D	$\{2\tfrac12,\,1\tfrac12\}$	*928053+x*	
$4d$ $^2P_2$	$2s^2\,2p^2(^3P)4d$	$4d$ ^2P	$1\tfrac12$ $\tfrac12$	*937669+x*	
$4d$ $^4D_{23}$ $^4D_1$	$2s^2\,2p^2(^3P)4d$	$4d$ ^4D	$3\tfrac12$ $2\tfrac12$ $1\tfrac12$ $\tfrac12$	939055 939858	−803
$4d$ $^2F_3$ $^2F_4$	$2s^2\,2p^2(^3P)4d$	$4d$ ^2F	$2\tfrac12$ $3\tfrac12$	*940380+x* *941392+x*	1012
$4d$ $^4P_3$ $^4P_2$	$2s^2\,2p^2(^3P)4d$	$4d$ ^4P	$2\tfrac12$ $1\tfrac12$ $\tfrac12$	940716 940929	−213
$4d$ $^2D_2$ $^2D_3$	$2s^2\,2p^2(^3P)4d$	$4d$ ^2D	$1\tfrac12$ $2\tfrac12$	*944022+x* *944334+x*	312
$\overline{3p'}$ $^2F_4$ $^2F_3$	$2s\,2p^3(^3D°)3p$	$3p^{IV}\,^2F$	$3\tfrac12$ $2\tfrac12$	*949462+x* *949984+x*	−522
$\overline{4d}$ ^2F	$2s^2\,2p^2(^1D)4d$	$4d'$ ^2F	$\{3\tfrac12,\,2\tfrac12\}$	*973350+x*	
$\overline{4d}$ ^2D	$2s^2\,2p^2(^1D)4d$	$4d'$ ^2D	$\{1\tfrac12,\,2\tfrac12\}$	*974048+x*	
$\overline{3d'}$ $^4P_3$ $^4P_2$ $^4P_1$	$2s\,2p^3(^3D°)3d$	$3d^{IV}$ $^4P°$	$2\tfrac12$ $1\tfrac12$ $\tfrac12$	*1004404* *1004626* *1004794*	−222 −168
$\overline{3d'}$ ^4D	$2s\,2p^3(^3D°)3d$	$3d^{IV}$ $^4D°$	$\{\tfrac12 \text{ to } 3\tfrac12\}$	*1008214*	
$\overline{\overline{3d'}}$ $^4S_2$	$2s\,2p^3(^3D°)3d$	$3d^{IV}$ $^4S°$	$1\tfrac12$	*1008941*	
$\overline{3d'}$ $^2F_4$ $^2F_3$	$2s\,2p^3(^3D°)3d$	$3d^{IV}$ $^2F°$	$3\tfrac12$ $2\tfrac12$	*1010088+x* *1010565+x*	−477
$5d$ ^2F	$2s^2\,2p^2(^1D)5d$	$5d'$ ^2F	$\{3\tfrac12,\,2\tfrac12\}$	*1038208+x*	
$\overline{5d}$ ^2D	$2s^2\,2p^2(^1D)5d$	$5d'$ ^2D	$\{1\tfrac12,\,2\tfrac12\}$	*1038845+x*	
Na VI ($^3P_0$)	*Limit*			*1118170*	

Config. $1s^2+$	Observed Terms		
$2s^2\ 2p^3$	$\begin{cases}2p^3\ {}^4S^o\end{cases}$ $\quad 2p^3\ {}^2P^o \qquad 2p^3\ {}^2D^o$		
$2s\ 2p^4$	$\begin{cases}2p^4\ {}^2S\end{cases}$ $\begin{matrix}2p^4\ {}^4P\\ 2p^4\ {}^2P\end{matrix}\qquad 2p^4\ {}^2D$		
$2p^5$	$2p^5\ {}^2P^o$		

	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\ 2p^2(^3P)\,nx$	$\begin{cases} 3,\,4s\ \ {}^4P\\ 3,\,4s\ \ {}^2P\end{cases}$		$\begin{matrix}3,\,4d\ \ {}^4P & 3,\,4d\ \ {}^4D\\ 3,\,4d\ \ {}^2P & 3,\,4d\ \ {}^2D & 3,\,4d\ \ {}^2F\end{matrix}$
$2s^2\ 2p^2(^1D)\,nx'$	$3,\,4s'\ \ {}^2D$		$3d'\ \ {}^2S \quad 3d'\ \ {}^2P \quad 3\text{–}5d'\ \ {}^2D \quad 3\text{–}5d'\ \ {}^2F$
$2s^2\ 2p^2(^1S)\,nx''$	$3s''\ \ {}^2S$		$3d''\ \ {}^2D$
$2s\ 2p^3(^5S^o)\,nx'''$	$3s'''\ \ {}^4S^o$	$3p'''\ \ {}^4P$	$3d'''\ {}^4D^o$
$2s\ 2p^3(^3D^o)\,nx^{IV}$	$\begin{cases}3s^{IV}\ {}^4D^o\\ 3s^{IV}\ {}^2D^o\end{cases}$	$3p^{IV}\ {}^2F$	$3d^{IV}\ {}^4S^o \quad 3d^{IV}\ {}^4P^o \quad 3d^{IV}\ {}^4D^o \quad 3d^{IV}\ {}^2F^o$
$2s\ 2p^3(^3P^o)\,nx^{V}$	$3s^{V}\ \ {}^4P^o$		

*For predicted terms in the spectra of the N i isoelectronic sequence, see Introduction.

Na VI

(C i sequence; 6 electrons) $\hfill Z=11$

Ground state $1s^2\ 2s^2\ 2p^2\ {}^3P_0$

$2p^2\ {}^3P_0$ **1390558** cm^{-1} $\hfill$ I. P. 172.36 volts

The analysis is by Söderqvist, who has found 63 terms and classified 134 lines in the range between 80 A and 638 A. He determines the relative values of terms of different multiplicity from the series limits, although he lists a few observed singlet-triplet combinations. His term $2p^4\ {}^1D$ has been corrected to agree with the two observed combinations.

Söderqvist gives the quintet term $2p^3\ {}^5S^o_2$ at 103187 cm^{-1} above the ground state zero. From isoelectronic sequence data Robinson estimates this value as 103508 cm^{-1}. The later value has been used in the table and all quintet terms adjusted accordingly. The uncertainty, x, may be a few hundred cm^{-1}.

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H. A. Robinson, unpublished material (March 1948). (T)

Author	Config.	Desig.	J	Level	Interval
$2p$ $^3P_0$	$2s^2\,2p^2$	$2p^2$ ^3P	0	0	698
$^3P_1$			1	698	1160
$^3P_2$			2	1858	
$2p$ $^1D_2$	$2s^2\,2p^2$	$2p^2$ ^1D	2	35358	
$2p$ $^1S_0$	$2s^2\,2p^2$	$2p^2$ ^1S	0	74274	
$2p'$ $^5S_2$	$2s\,2p^3$	$2p^3$ $^5S^\circ$	2	103508+x	
$2p'$ $^3D_3$	$2s\,2p^3$	$2p^3$ $^3D^\circ$	3	204131	−91
$^3D_2$			2	204222	−38
$^3D_1$			1	204260	
$2p'$ ^3P	$2s\,2p^3$	$2p^3$ $^3P^\circ$	2, 1, 0	241341	
$2p'$ $^1D_2$	$2s\,2p^3$	$2p^3$ $^1D^\circ$	2	312175	
$2p'$ $^3S_1$	$2s\,2p^3$	$2p^3$ $^3S^\circ$	1	320589	
$2p'$ $^1P_1$	$2s\,2p^3$	$2p^3$ $^1P^\circ$	1	350179	
$2p''$ $^3P_2$	$2p^4$	$2p^4$ ^3P	2	477277	−1320
$^3P_1$			1	478597	−559
$^3P_0$			0	479156	
$2p''$ $^1D_2$	$2p^4$	$2p^4$ ^1D	2	539310	
	$2s^2\,2p(^2P^\circ)3s$	$3s$ $^3P^\circ$	0		
$3s$ $^3P_1$			1	807324	1471
$^3P_2$			2	808795	
$3s$ $^1P_1$	$2s^2\,2p(^2P^\circ)3s$	$3s$ $^1P^\circ$	1	817598	
	$2s^2\,2p(^2P^\circ)3p$	$3p$ ^3P	0		
$3p$ $^3P_1$			1	872577	710
$^3P_2$			2	873287	
$3d$ $^3F_2$	$2s^2\,2p(^2P^\circ)3d$	$3d$ $^3F^\circ$	2	919476	
			3		
			4		
$3d$ $^1D_2$	$2s^2\,2p(^2P^\circ)3d$	$3d$ $^1D^\circ$	2	920706	
$3s'$ $^5P_1$	$2s\,2p^2(^4P)3s$	$3s$ ^5P	1	923059+x	706
$^5P_2$			2	923765+x	943
$^5P_3$			3	924708+x	
$3d$ $^3D_1$	$2s^2\,2p(^2P^\circ)3d$	$3d$ $^3D^\circ$	1	929774	225
$^3D_2$			2	929999	511
$^3D_3$			3	930510	
$3d$ $^3P_2$	$2s^2\,2p(^2P^\circ)3d$	$3d$ $^3P^\circ$	2	933915	−548
$^3P_1$			1	934463	−282
$^3P_0$			0	934745	
$3d$ $^1F_3$	$2s^2\,2p(^2P^\circ)3d$	$3d$ $^1F^\circ$	3	945309	
$3d$ $^1P_1$	$2s^2\,2p(^2P^\circ)3d$	$3d$ $^1P^\circ$	1	946392	
$3s'$ $^3P_0$	$2s\,2p^2(^4P)3s$	$3s$ ^3P	0	949778	589
$^3P_1$			1	950367	1022
$^3P_2$			2	951389	
$3p'$ $^3S_1$	$2s\,2p^2(^4P)3p$	$3p$ $^3S^\circ$	1	970835	
	$2s\,2p^2(^4P)3p$	$3p$ $^3D^\circ$	1		
$3p'$ $^3D_2$			2	996011	
$^3D_3$			3	996734	723
	$2s\,2p^2(^4P)3p$	$3p$ $^3P^\circ$	0		
$3p'$ $^3P_1$			1	1005068	
$^3P_2$			2	1005713	645
$\overline{3s}'$ ^3D	$2s\,2p^2(^2D)3s$	$3s'$ ^3D	1, 2, 3	1016274	
$\overline{3s}'$ $^1D_2$	$2s\,2p^2(^2D)3s$	$3s'$ ^1D	2	1033221	

Author	Config.	Desig.	J	Level	Interval
$3p'$ ^3D	$2s\,2p^2(^2D)3p$	$3p'$ $^3D^\circ$	1, 2, 3	1040223	
	$2s\,2p^2(^4P)3d$	$3d$ ^5D	0		
$3d'$ $^5D_{23}$			{ 1 2 3 4 }	1041771+x	
$3d'$ $^5P_3$	$2s\,2p^2(^4P)3d$	$3d$ ^5P	3	1045793+x	−427
$^5P_2$			2	1046220+x	−328
$^5P_1$			1	1046548+x	
$3d'$ $^3P_2$	$2s\,2p^2(^4P)3d$	$3d$ ^3P	2	1047408	−696
$^3P_1$			1	1048104	
			0		
$3d'$ $^3F_2$	$2s\,2p^2(^4P)3d$	$3d$ ^3F	2	1053885	612
$^3F_3$			3	1054497	763
$^3F_4$			4	1055260	
$3d'$ $^3D_1$	$2s\,2p^2(^4P)3d$	$3d$ ^3D	1	1067760	211
$^3D_2$			2	1067971	287
$^3D_3$			3	1068258	
$\overline{3p}'$ $^1F_3$	$2s\,2p^2(^2D)3p$	$3p'$ $^1F^\circ$	3	1071896	
$\overline{3p}'$ $^1D_2$	$2s\,2p^2(^2D)3p$	$3p'$ $^1D^\circ$	2	1077752	
	$2s^2\,2p(^2P^\circ)4s$	$4s$ $^3P^\circ$	0		
			1		
$4s$ $^3P_2$			2	1090756	
$\overline{3d}'$ ^3F	$2s\,2p^2(^2D)3d$	$3d'$ ^3F	2, 3, 4	1125323	
$4d$ $^3F_2$	$2s^2\,2p(^2P^\circ)4d$	$4d$ $^3F^\circ$	2	1128693	
			3		
			4		
$\overline{3d}'$ ^3P	$2s\,2p^2(^2D)3d$	$3d'$ ^3P	0, 1, 2	1130631	
$4d$ $^1D_2$	$2s^2\,2p(^2P^\circ)4d$	$4d$ $^1D^\circ$	2	1131032	
$4d$ $^3D_1$	$2s^2\,2p(^2P^\circ)4d$	$4d$ $^3D^\circ$	1	1133491	380
$^3D_2$			2	1133871	875
$^3D_3$			3	1134746	
$\overline{3d}'$ ^3D	$2s\,2p^2(^2D)3d$	$3d'$ ^3D	1, 2, 3	1134094	
	$2s^2\,2p(^2P^\circ)4d$	$4d$ $^3P^\circ$	0		
			1		
$4d$ $^3P_2$			2	1136378	
$4d$ $^1F_3$	$2s^2\,2p(^2P^\circ)4d$	$4d$ $^1F^\circ$	3	1140721	
$\overline{3d}'$ $^3S_1$	$2s\,2p^2(^2D)3d$	$3d'$ ^3S	1	1144276	
$\overline{3d}'$ $^1F_3$	$2s\,2p^2(^2D)3d$	$3d'$ ^1F	3	1147708	
$\overline{3d}'$ $^1D_2$	$2s\,2p^2(^2D)3d$	$3d'$ ^1D	2	1147735	
$\overline{3d}'$ $^1P_1$	$2s\,2p^2(^2D)3d$	$3d'$ ^1P	1	1151140	
	$2s\,2p^2(^4P)4s$	$4s$ ^5P	1		
			2		
$4s'$ $^5P_3$			3	1205485+x	
	$2s\,2p^2(^4P)4s$	$4s$ ^2P	0		
			1		
$4s'$ $^3P_2$			2	1214191	
	$2s^2\,2p(^2P^\circ)5d$	$5d$ $^3D^\circ$	1		
			2		
$5d$ $^3D_3$			3	1228205	
	$2s^2\,2p(^2P^\circ)5d$	$5d$ $^3P^\circ$	0		
			1		
$5d$ $^3P_2$			2	1228882	

Na VI—Continued

Author	Config.	Desig.	J	Level	Interval
$5d$ $^1F_3$	$2s^2\,2p(^2P°)5d$	$5d$ $^1F°$	3	*1230972*	
	$2s\,2p^2(^4P)4d$	$4d$ ^5P	1 2		
$4d'$ $^5P_3$			3	$1250152+x$	
$4d'$ $^3F_2$ $^3F_3$ $^3F_4$	$2s\,2p^2(^4P)4d$	$4d$ ^3F	2 3 4	1253369 1253947 1254750	578 803
$4d'$ ^3D	$2s\,2p^2(^4P)4d$	$4d$ ^3D	1, 2, 3	1258613	
$3p''$ ^3P	$1s^2\,2p^3(^4S°)3p$	$3p^{IV}$ ^3P	0, 1, 2	1265583	
$6d$ $^1F_3$	$2s^2\,2p(^2P°)6d$	$6d$ $^1F°$	3	*1279991*	

Na VI—Continued

Author	Config.	Desig.	J	Level	Interval
$\overline{4d'}$ ^3F	$2s\,2p^2(^2D)4d$	$4d'$ ^3F	2, 3, 4	1334585	
$\overline{4d'}$ ^3P	$2s\,2p^2(^2D)4d$	$4d'$ ^3P	0, 1, 2	1335519	
$\overline{4d'}$ ^3D	$2s\,2p^2(^2D)4d$	$4d'$ ^3D	1, 2, 3	1337017	
	$2s\,2p^2(^4P)5d$	$5d$ ^5P	1 2		
$5d'$ $^5P_3$			3	$1343510+x$	
Na VII ($^2P°_{1/2}$)		*Limit*	------	1390558	
$\overline{5d'}$ ^3F	$2s\,2p^2(^2D)5d$	$5d'$ ^3F	2, 3, 4	1429862	

March 1948.

Na VI Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^2$	{$2p^2$ ^1S $2p^2$ ^3P $2p^2$ ^1D		
$2s\,2p^3$	{$2p^3$ $^5S°$ $2p^3$ $^3S°$ $2p^3$ $^3P°$ $2p^3$ $^3D°$ $2p^3$ $^1P°$ $2p^3$ $^1D°$		
$2p^4$	{$2p^4$ ^3P $2p^4$ ^1D		

Config. $1s^2+$	ns $(n\geq 3)$	np $(n\geq 3)$	nd $(n\geq 3)$
$2s^2\,2p(^2P°)nx$	{$3, 4s$ $^3P°$ / $3s$ $^1P°$	$3p$ ^3P	$3\text{–}5d$ $^3P°$ $3\text{–}5d$ $^3D°$ $3, 4d$ $^3F°$ / $3d$ $^1P°$ $3, 4d$ $^1D°$ $3\text{–}6d$ $^1F°$
$2s\,2p^2(^4P)nx$	{$3, 4s$ ^5P / $3, 4s$ ^3P	$3p$ $^3S°$ $3p$ $^3P°$ $3p$ $^3D°$	$3\text{–}5d$ ^5P $3d$ ^5D / $3d$ ^3P $3, 4d$ ^3D $3, 4d$ ^3F
$2s\,2p^2(^2D)nx'$	{$3s'$ ^3D / $3s'$ ^1D	$3p'$ $^3D°$ $3p'$ $^1D°$ $3p'$ $^1F°$	$3d'$ ^3S $3, 4d'$ ^3P $3, 4d'$ ^3D $3\text{–}5d'$ ^3F / $3d'$ ^1P $3d'$ ^1D $3d'$ ^1F
$2p^3(^4S°)nx^{IV}$		$3p^{IV}$ ^3P	

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

Na VII

(B I sequence; 5 electrons) $Z=11$

Ground state $1s^2\,2s^2\,2p$ $^2P°_{1/2}$

$2p$ $^2P°_{1/2}$ *1681679* cm^{-1} I. P. 208.444 volts

All of the terms are taken from Söderqvist's later publication. The Grotrian diagram in the earlier paper should be extended to include the more complete analysis of 1944. He has classified 158 lines in the region between 62 A and 491 A.

The absolute values of the doublet terms are well determined. Those of the quartets are derived from the nd $^4D°$ ($n=3, 4, 5$) series; and the relative uncertainty x, may be a few hundred cm^{-1}. No intersystem combinations have been observed.

Na VII—Continued

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Na VII   **Na VII**

Author	Config.	Desig.	J	Level	Interval	Author	Config.	Desig.	J	Level	Interval
$2p$ $^2P_1$ $^2P_2$	$2s^2(^1S)2p$	$2p$ $^2P°$	½ 1½	_0_ _2139_	2139	$\overline{3p'}$ $^2D_2$ $^2D_3$	$2s\ 2p(^1P°)3p$	$3p'$ ^2D	1½ 2½	1251674 1252014	340
$2p'$ $^4P_1$ $^4P_2$ $^4P_3$	$2s\ 2p^2$	$2p^2$ ^4P	½ 1½ 2½	115187+x 115920+x 116987+x	733 1067	$\overline{3p'}$ $^2P_1$ $^2P_2$	$2s\ 2p(^1P°)3p$	$3p'$ ^2P	½ 1½	1253353 1253779	426
$2p'$ $^2D_3$ $^2D_2$	$2s\ 2p^2$	$2p^2$ ^2D	2½ 1½	205412 205448	−36	$\overline{3p'}$ $^2S_1$	$2s\ 2p(^1P°)3p$	$3p'$ ^2S	½	1258878	
$2p'$ $^2S_1$	$2s\ 2p^2$	$2p^2$ ^2S	½	264400		$3s''$ $^4P_2$ $^4P_3$	$2p^2(^3P)3s$	$3s''$ ^4P	½ 1½ 2½	1290221+x 1291755+x	1534
$2p'$ $^2P_1$ $^2P_2$	$2s\ 2p^2$	$2p^2$ ^2P	½ 1½	283869 285189	1320	$\overline{3d'}$ ^2F	$2s\ 2p(^1P°)3d$	$3d'$ $^2F°$	{ 2½ 3½ }	_1292333_	
$2p''$ $^4S_2$	$2p^3$	$2p^3$ $^4S°$	1½	_367481+x_		$4s$ $^2S_1$	$2s^2(^1S)4s$	$4s$ ^2S	½	1294914	
$2p''$ $^2D_3$ $^2D_2$	$2p^3$	$2p^3$ $^2D°$	2½ 1½	_412311_ _412395_	−84	$\overline{3d'}$ $^2D_2$ $^2D_3$	$2s\ 2p(^1P°)3d$	$3d'$ $^2D°$	1½ 2½	_1303445_ _1303643_	198
$2p''$ $^2P_1$ $^2P_2$	$2p^3$	$2p^3$ $^2P°$	½ 1½	_465017_ _465111_	94	$\overline{3d'}$ ^2P	$2s\ 2p(^1P°)3d$	$3d'$ $^2P°$	{ ½ 1½ }	_1306468_	
$3s$ $^2S_1$	$2s^2(^1S)3s$	$3s$ ^2S	½	951347		$\overline{3s''}$ $^2D_2$ $^2D_3$	$2p^2(^1D)3s$	$3s'''$ ^2D	1½ 2½	1331137 1331974	837
	$2s^2(^1S)3p$	$3p$ $^2P°$	½ 1½	_1008418_		$4d$ $^2D_2$ $^2D_3$	$2s^2(^1S)4d$	$4d$ ^2D	1½ 2½	1335809 1335889	80
$3d$ $^2D_2$ $^2D_3$	$2s^2(^1S)3d$	$3d$ ^2D	1½ 2½	1060580 1060699	119		$2p^2(^3P)3p$	$3p''$ $^4D°$	½ 1½ 2½ 3½	_1338659+x_	
$3s'$ $^4P_1$ $^4P_2$ $^4P_3$	$2s\ 2p(^3P°)3s$	$3s$ $^4P°$	½ 1½ 2½	_1077458+x_ _1078190+x_ _1079520+x_	732 1330	$3p''$ $^4D_4$	$2p^2(^3P)3p$	$3p''$ $^4P°$	½ 1½ 2½	_1345036+x_	
$3s'$ $^2P_1$ $^2P_2$	$2s\ 2p(^3P°)3s$	$3s$ $^2P°$	½ 1½	_1103222_ _1104620_	1398	$3p''$ $^4P_3$					
$3p'$ $^2P_1$ $^2P_2$	$2s\ 2p(^3P°)3p$	$3p$ ^2P	½ 1½	1126810 1127431	621	$3p''$ ^2D	$2p^2(^3P)3p$	$3p''$ $^2D°$	{ 1½ 2½ }	_1348721_	
$3p'$ $^2D_2$ $^2D_3$	$2s\ 2p(^3P°)3p$	$3p$ ^2D	1½ 2½	1154779 1156180	1401	$3p''$ $^4S_2$	$2p^2(^3P)3p$	$3p''$ $^4S°$	1½	_1363160+x_	
$3p'$ $^2S_1$	$2s\ 2p(^3P°)3p$	$3p$ ^2S	½	1172339		$\overline{3p''}$ $^2F_3$ $^2F_4$	$2p^2(^1D)3p$	$3p'''^2F°$	2½ 3½	_1377822_ _1378295_	473
$3d'$ $^4D_2$ $^4D_3$ $^4D_4$	$2s\ 2p(^3P°)3d$	$3d$ $^4D°$	½ 1½ 2½ 3½	_1185931+x_ _1186190+x_ _1186666+x_	259 476	$3d''$ $^2F_3$ $^2F_4$	$2p^2(^3P)3d$	$3d''$ ^2F	2½ 3½	_1388500?_ _1388969?_	469
$3d'$ $^2D_2$ $^2D_3$	$2s\ 2p(^3P°)3d$	$3d$ $^2D°$	1½ 2½	_1186628_ _1187885_	1257	$3d''$ ^2D	$2p^2(^3P)3d$	$3d''$ ^2D	{ 1½ 2½ }	_1390448?_	
$3d'$ $^4P_3$ $^4P_2$ $^4P_1$	$2s\ 2p(^3P°)3d$	$3d$ $^4P°$	2½ 1½ ½	_1192538+x_ _1193059+x_ _1193402+x_	−521 −343	$\overline{3p''}$ ^2D	$2p^2(^1D)3p$	$3p'''^2D°$	{ 1½ 2½ }	_1392764_	
$\overline{3s'}$ ^2P	$2s\ 2p(^1P°)3s$	$3s'$ $^2P°$	{ ½ 1½ }	_1198287_		$3d''$ $^4P_3$ $^4P_2$ $^4P_1$	$2p^2(^3P)3d$	$3d''$ ^4P	2½ 1½ ½	1399238+x 1399771+x 1400059+x	−533 −288
$3d'$ $^2F_3$ $^2F_4$	$2s\ 2p(^3P°)3d$	$3d$ $^2F°$	2½ 3½	_1209908_ _1211236_	1328	$\overline{3d''}$ ^2D	$2p^2(^1D)3d$	$3d'''^2D$	{ 1½ 2½ }	_1415636_	
$3d'$ $^2P_2$ $^2P_1$	$2s\ 2p(^3P°)3d$	$3d$ $^2P°$	1½ ½	_1217189_ _1217955_	−766	$4s'$ $^4P_3$	$2s\ 2p(^3P°)4s$	$4s$ $^4P°$	½ 1½ 2½	_1423050+x_	

Na VII—Continued

Author	Config.	Desig.	J	Level	Interval
$\overline{3d''}$ ²F₃ ²F₄	2p²(¹D)3d	3d'''²F	2½ 3½	1428717 1428798	81
$\overline{3d''}$ ²P₁ ²P₂	2p²(¹D)3d	3d'''²P	½ 1½	1432135 1432606	471
4s' ²P₂	2s 2p(³P°)4s	4s ²P°	½ 1½	*1432595*	
4p' ²P₁ ²P₂	2s 2p(³P°)4p	4p ²P	½ 1½	1442711 1443165	454
4p' ²D₂ ²D₃	2s 2p(³P°)4p	4p ²D	1½ 2½	1452095 1453349	1254
5d ²D₂ ²D₃	2s²(¹S)5d	5d ²D	1½ 2½	1461518 1461588	70
4d' ⁴D₂ ⁴D₃ ⁴D₄	2s 2p(³P°)4d	4d ⁴D°	½ 1½ 2½ 3½	1462587+x 1462631+x 1463462+x	44 831
4d' ²D₃	2s 2p(³P°)4d	4d ²D°	1½ 2½	*1464051*	
4d' ⁴P₃	2s 2p(³P°)4d	4d ⁴P°	2½ 1½ ½	*1465059+x*	
4d' ²F₃ ²F₄	2s 2p(³P°)4d	4d ²F°	2½ 3½	*1471559 1472727*	1168
4d' ²P₂ ²P₁	2s 2p(³P°)4d	4d ²P°	1½ ½	*1473809 1474526*	−717
6d ²D	2s²(¹S)6d	6d ²D	{ 1½ 2½ }	1529463	
$\overline{4s'}$ ²P	2s 2p(¹P°)4s	4s' ²P°	{ ½ 1½ }	1538951	

Na VII—Continued

Author	Config.	Desig.	J	Level	Interval
4p' ²D	2s 2p(¹P°)4p	4p' ²D	{ 1½ 2½ }	1561885	
7d ²D	2s²(¹S)7d	7d ²D	{ 1½ 2½ }	1570078	
$\overline{4d'}$ ²F	2s 2p(¹P°)4d	4d' ²F°	{ 2½ 3½ }	*1577813?*	
5p' ²P	2s 2p(³P°)5p	5p ²P	{ ½ 1½ }	1578354	
5p' ²D	2s 2p(³P°)5p	5p ²D	{ 1½ 2½ }	1583742	
5d' ⁴D	2s 2p(³P°)5d	5d ⁴D°	{ ½ to 3½ }	*1589481+x*	
5d' ⁴P	2s 2p(³P°)5d	5d ⁴P°	{ ½ to 2½ }	*1590240+x*	
5d' ²F₃ ²F₄	2s 2p(³P°)5d	5d ²F°	2½ 3½	*1592815 1593915*	11
8d ²D	2s²(¹S)8d	8d ²D	{ 1½ 2½ }	1596400	
4p'' ⁴D	2p²(³P)4p	4p'' ⁴D°	{ ½ to 3½ }	*1646320+x*	
6d' ⁴P 6d' ⁴D	} 2s 2p(³P°)6d	6d ⁴P° 6d ⁴D°	{ ½ to 3½ }	*1657724+x*	
4d'' ⁴P₃ ⁴P₂	2p²(³P)4d	4d'' ⁴P	2½ 1½ ½	*1668514+x 1668855+x*	−341
Na VIII (¹S°)	Limit	------		***1681679***	

October 1946.

Na VII Observed Terms*

Config. 1s²+	Observed Terms		
2s²(¹S)2p	2p ²P°		
2s 2p²	{ 2p² ²S 2p² ⁴P 2p² ²P 2p² ²D		
2p³	{ 2p³ ⁴S° 2p³ ²P° 2p³ ²D°		
	ns (n≥3)	**np (n≥3)**	**nd (n≥3)**
2s²(¹S)nx	3, 4s ³S	3p ²P°	3–8d ²D
2s 2p(³P°)nx	{ 3, 4s ⁴P° 3, 4s ²P°	3p ²S 3–5p ²P 3–5p ²D	3–6d ⁴P° 3–6d ⁴D° 3, 4d ²P° 3, 4d ²D° 3–5d ²F°
2s 2p(¹P°)nx'	3, 4s' ²P°	3p' ²S 3p' ²P 3, 4p' ²D	3d' ²P° 3d' ²D° 3, 4d' ²F°
2p²(³P)nx''	{ 3s''⁴P	3p'' ⁴S° 3p'' ⁴P° 3, 4p'' ⁴D° 3p'' ²D°	3, 4d'' ⁴P 3d'' ²D 3d'' ²F
2p²(¹D)nx'''	3s''' ²D	3p''' ²D° 3p''' ²F°	3d''' ²P 3d''' ²D 3d''' ²F

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

Na VIII

(Be I sequence; 4 electrons) $Z=11$

Ground state $1s^2\, 2s^2\, {}^1S_0$

$2s^2\, {}^1S_0$ **2131139** cm^{-1} I. P. 264.155 volts

Eighty-six lines have been classified by Söderqvist, all but three of which are in the region between 51 A and 117 A. No intersystem combinations are known, but the absolute term values are well determined by the series, the relative uncertainty x being probably a few hundred cm^{-1}.

<div align="center">REFERENCE</div>

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **30A,** No. 11, p. 7 (1944). (I P) (T) (C L)

<div align="center">Na VIII   Na VIII</div>

Author	Config.	Desig.	J	Level	Interval	Author	Config.	Desig.	J	Level	Interval
$2s$ ${}^1S_0$	$2s^2$	$2s^2$ ${}^1S$	0	0		$3p'$ ${}^1P_1$	$2p({}^2P°)3p$	$3p$ ${}^1P$	1	1432991	
$2p$ ${}^3P_0$	$2s({}^2S)2p$	$2p$ ${}^3P°$	0	$126053+x$		$3p'$ ${}^3D_1$	$2p({}^2P°)3p$	$3p$ ${}^3D$	1	$1439584+x$	
${}^3P_1$			1	$126783+x$	730	${}^3D_2$			2	$1440430+x$	846
${}^3P_2$			2	$128387+x$	1604	${}^3D_3$			3	$1442050+x$	1620
$2p$ ${}^1P_1$	$2s({}^2S)2p$	$2p$ ${}^1P°$	1	243223		$3p'$ ${}^3S_1$	$2p({}^2P°)3p$	$3p$ ${}^3S$	1	$1452568+x$	
$2p'$ ${}^3P_0$	$2p^2$	$2p^2$ ${}^3P$	0	$327667+x$			$2p({}^2P°)3p$	$3p$ ${}^3P$	0		
${}^3P_1$			1	$328494+x$	827	$3p'$ ${}^3P_1$			1	$1460244+x$	884
${}^3P_2$			2	$329899+x$	1405	${}^3P_2$			2	$1461128+x$	
$2p'$ ${}^1D_2$	$2p^2$	$2p^2$ ${}^1D$	2	361046		$3d'$ ${}^1D_2$	$2p({}^2P°)3d$	$3d$ ${}^1D°$	2	1469055	
$2p'$ ${}^1S_0$	$2p^2$	$2p^2$ ${}^1S$	0	446099		$3p'$ ${}^1D_2$	$2p({}^2P°)3p$	$3p$ ${}^1D$	2	1474598	
$3s$ ${}^3S_1$	$2s({}^2S)3s$	$3s$ ${}^3S$	1	$1240255+x$		$3p'$ ${}^1S_0$	$2p({}^2P°)3p$	$3p$ ${}^1S$	0	1481521	
$3s$ ${}^1S_0$	$2s({}^2S)3s$	$3s$ ${}^1S$	0	1262799		$3d'$ ${}^3D_1$	$2p({}^2P°)3d$	$3d$ ${}^3D°$	1	$1485329+x$	
$3p$ ${}^1P_1$	$2s({}^2S)3p$	$3p$ ${}^1P°$	1	1294214		${}^3D_2$			2	$1485621+x$	292
$3d$ ${}^3D_1$	$2s({}^2S)3d$	$3d$ ${}^3D$	1	$1327399+x$		${}^3D_3$			3	$1486249+x$	628
${}^3D_2$			2	$1327436+x$	37	$3d'$ ${}^3P_2$	$2p({}^2P°)3d$	$3d$ ${}^3P°$	2	$1492167+x$	
${}^3D_3$			3	$1327557+x$	121	${}^3P_1$			1	$1492809+x$	−642
						${}^3P_0$			0	$1493167+x$	−358
$3d$ ${}^1D_2$	$2s({}^2S)3d$	$3d$ ${}^1D$	2	1347756		$3d'$ ${}^1F_3$	$2p({}^2P°)3d$	$3d$ ${}^1F°$	3	1507690	
$3s'$ ${}^3P_0$	$2p({}^2P°)3s$	$3s$ ${}^3P°$	0	$1399858+x$		$3d'$ ${}^1P_1$	$2p({}^2P°)3d$	$3d$ ${}^1P°$	1	1513677	
${}^3P_1$			1	$1400663+x$	805	$4s$ ${}^3S_1$	$2s({}^2S)4s$	$4s$ ${}^3S$	1	$1649682+x$	
${}^3P_2$			2	$1402377+x$	1714	$4s$ ${}^1S_0$	$2s({}^2S)4s$	$4s$ ${}^1S$	0	1656830	
$3s'$ ${}^1P_1$	$2p({}^2P°)3s$	$3s$ ${}^1P°$	1	1426049		$4p$ ${}^1P_1$	$2s({}^2S)4p$	$4p$ ${}^1P°$	1	1673388	

Na VIII—Continued

Author	Config.	Desig.	J	Level	Interval
4d ³D	2s(²S)4d	4d ³D	1, 2, 3	1683549+x	
4d ¹D₂	2s(²S)4d	4d ¹D	2	1689982	
4p' ¹P₁	2p(²P°)4p	4p ¹P	1	1813205	
4p' ³D₂ / ³D₃	2p(²P°)4p	4p ³D	1 / 2 / 3	1816179+x / 1817462+x	1283
4p' ³P₂	2p(²P°)4p	4p ³P	0 / 1 / 2	1823044+x	
4d' ¹D₂	2p(²P°)4d	4d ¹D°	2	1827472	
4p' ¹D₂	2p(²P°)4p	4p ¹D	2	1827658	
4d' ³D₃	2p(²P°)4d	4d ³D°	1 / 2 / 3	1833704+x	
4d' ³P₂	2p(²P°)4d	4d ³P°	2 / 1 / 0	1835175+x	
4d' ¹F₃	2p(²P°)4d	4d ¹F°	3	1838762	
5p ¹P₁	2s(²S)5p	5p ¹P°	1	1838911	
4d' ¹P₁	2p(²P°)4d	4d ¹P°	1	1843384	
5d ³D	2s(²S)5d	5d ³D	1, 2, 3	1848841+x	

Na VIII—Continued

Author	Config.	Desig.	J	Level	Interval
5d ¹D₂	2s(²S)5d	5d ¹D	2	1848978	
6p ¹P₁	2s(²S)6p	6p ¹P°	1	1930912	
6d ³D	2s(²S)6d	6d ³D	1, 2, 3	1933601+x	
6d ¹D₂	2s(²S)6d	6d ¹D	2	1935242	
5p' ³P	2p(²P°)5p	5p ³P	0, 1, 2	1988852+x	
5p' ¹D₂	2p(²P°)5p	5p ¹D	2	1990558	
5d' ¹D₂	2p(²P°)5d	5d ¹D°	2	1991118	
5d' ³D	2p(²P°)5d	5d ³D°	1, 2, 3	1994540+x	
5d' ³P	2p(²P°)5d	5d ³P°	2, 1, 0	1995095+x	
5d' ¹F₃	2p(²P°)5d	5d ¹F°	3	1998029	
6p' ³D	2p(²P°)6p	6p ³D	1, 2, 3	2077097+x	
6d' ³D	2p(²P°)6d	6d ³D°	1, 2, 3	2080630+x	
6d' ³P	2p(²P°)6d	6d ³P°	2, 1, 0	2081335+x	
6d' ¹F₃	2p(²P°)6d	6d ¹F°	3	2083106	
Na IX (^{2}S$_{1/2}$)	Limit	------		2131139	

May 1946.

Na VIII Observed Terms*

Config. 1s²+	Observed Terms		
2s²	2s² ¹S		
2s(²S)2p	{ 2p ³P° 〈 2p ¹P°		
2p²	{ 2p² ¹S 2p² ³P 2p² ¹D		

Config. 1s²+	ns (n≥3)	np (n≥3)	nd (n≥3)
2s(²S)nx	{3, 4s ³S 〈3, 4s ¹S	3–6p ¹P°	3–6d ³D 3–6d ¹D
2p(²P°)nx	{ 3s ³P° 〈 3s ¹P°	3p ³S 3–5p ³P 3, 4, 6p ³D 3p ¹S 3, 4p ¹P 3–5p ¹D	3–6d ³P° 3–6d ³D° 3, 4d ¹P° 3–5d ¹D° 3–6d ¹F°

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

Na IX

(Li I sequence; 3 electrons) $Z=11$

Ground state $1s^2\,2s\ ^2S_{1/2}$

$2s\ ^2S_{1/2}$ **2418520 cm^{-1}**   I. P. 299.78 volts

    The analysis is by Söderqvist, who has classified 22 lines in this spectrum.   They occur in the region 81 A to 44 A, with the exception of one line at 681 A.
    Some of the relative levels have been connected by a study of the Rydberg denominators in the isoelectronic sequence rather than by the Ritz combination principle.

REFERENCE

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **30A,** No. 11, p. 1 (1944).   (I P) (T) (C L)

Na IX

Author	Config.	Desig.	J	Level	Interval	Author	Config.	Desig.	J	Level	Interval
$2s\ ^2S_1$	$2s$	$2s\ ^2S$	½	0		$5p\ ^2P_{2\,1}$	$5p$	$5p\ ^2P^\circ$	{ ½ 1½ }	*2059605*	
$2p\ ^2P_1$ $^2P_2$	$2p$	$2p\ ^2P^\circ$	½ 1½	*144038* *146688*	2650	$5d\ ^2D_2$ $^2D_3$	$5d$	$5d\ ^2D$	1½ 2½	2062835 2062911	76
$3s\ ^2S_1$	$3s$	$3s\ ^2S$	½	1375944		$6p\ ^2P_{2\,1}$	$6p$	$6p\ ^2P^\circ$	{ ½ 1½ }	*2169668*	
$3p\ ^2P_1$ $^2P_2$	$3p$	$3p\ ^2P^\circ$	½ 1½	*1415368* *1416130*	762	$6d\ ^2D_2$ $^2D_3$	$6d$	$6d\ ^2D$	1½ 2½	2171366 2171553	187
$3d\ ^2D_2$ $^2D_3$	$3d$	$3d\ ^2D$	1½ 2½	1429980 1430204	224	$7p\ ^2P_{2\,1}$	$7p$	$7p\ ^2P^\circ$	{ ½ 1½ }	*2235886*	
$4s\ ^2S_1$	$4s$	$4s\ ^2S$	½	1840336		$7d\ ^2D_2$ $^2D_3$	$7d$	$7d\ ^2D$	1½ 2½	2237139 2237165	26
$4p\ ^2P_{2\,1}$	$4p$	$4p\ ^2P^\circ$	{ ½ 1½ }	*1856665*							
$4d\ ^2D_2$ $^2D_3$	$4d$	$4d\ ^2D$	1½ 2½	1862222 1862572	350	Na x ($^1S_0$)	*Limit*			2418520	
$5s\ ^2S_1$	$5s$	$5s\ ^2S$	½	2051922?							

May 1946.

MAGNESIUM

Mg I

12 electrons $Z=12$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,{}^1S_0$

$3s^2\,{}^1S_0$ **61669.14 cm⁻¹**   I. P. 7.644 volts

The most complete term array is given in Paschen's 1931 paper, which has been extensively used in the present compilation.

Paschen lists the combinations $3d\,{}^3D-nf\,{}^3F^\circ$ ($n=4,5$) and $3d\,{}^1D-nf\,{}^1F^\circ$ ($n=4\text{--}9$), deriving from his infrared observations practically coincident values for the terms $nf\,{}^3F^\circ$ and $nf\,{}^1F^\circ$ for $n=4$ and $n=5$. Assuming that the two F-series were coincident throughout, Russell, Babcock, and the writer extended both series by the identification of Paschen's lines in the Infrared Solar Spectrum and by the discovery of the constant solar wave-number separation $3d\,{}^3D-3d\,{}^1D$ for predicted successive series members. The constancy of this separation and the behavior of the solar lines in the disk and spot spectra leave no doubt as to the correctness of the identifications, although laboratory observations are lacking for confirmation of many of the lines. The term values in the table for the F-series ($nf\,{}^1F^\circ$ to $n=14$ and $nf\,{}^3F^\circ$ to $n=12$) have been calculated from solar data, with a slight adjustment to Paschen's absolute values of $3d\,{}^3D$ and $3d\,{}^1D$, as indicated in the 1945 reference below.

The three-decimal values listed for the terms $3p\,{}^3P^\circ$ and $3d\,{}^3D$ are from Meissner's paper.

Sawyer suggests that Paschen's $6d\,{}^1D$ term (58023.27 cm⁻¹ in the table) may have the designation $3p^2\,{}^1D$, in which case the n-values of the higher series members should be decreased by one unit. In accordance with the observations of Shenstone and Russell on related series, the $nd\,{}^1D$ series may well have absorbed the $3p^2\,{}^1D$ term. The present analysis indicates that throughout the D-series the singlets are lower than the corresponding triplet terms.

The singlet and triplet terms are well connected by intersystem combinations.

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Mg I

Config.	Desig.	J	Level	Interval
3s²	3s² ¹S	0	0.00	
3s(²S)3p	3p ³P°	0	21850.368	
		1	21870.426	20.058
		2	21911.140	40.714
3s(²S)3p	3p ¹P°	1	35051.36	
3s(²S)4s	4s ³S	1	41197.37	
3s(²S)4s	4s ¹S	0	43503.0	
3s(²S)3d	3d ¹D	2	46403.14	
3s(²S)4p	4p ³P°	0, 1	47847.7	
		2	47851.8	4.1
3s(²S)3d	3d ³D	3	47957.035	
		2	47957.018	0.017
		1	47957.047	−0.029
3s(²S)4p	4p ¹P°	1	49346.6	
3s(²S)5s	5s ³S	1	51872.36	
3s(²S)5s	5s ¹S	0	52556.37	
3s(²S)4d	4d ¹D	2	53134.70	
3s(²S)4d	4d ³D	3, 2, 1	54192.16	
3s(²S)5p	5p ³P°	0 / 1 / 2	54252.6	
3s(²S)4f	4f ³F°	2, 3, 4	54676.38	
3s(²S)4f	4f ¹F°	3	54676.38	
3s(²S)5p	5p ¹P°	1	54699.4	
3s(²S)6s	6s ³S	1	55891.83	
3s(²S)6s	6s ¹S	0	56187.03	
3s(²S)5d	5d ¹D	2	56308.43	
3s(²S)5d	5d ³D	3, 2, 1	56968.31	
3s(²S)6p	6p ³P°	0, 1	57018.8	
		2	57020.1	1.3
3s(²S)5f	5f ³F°	2, 3, 4	57204.22	
3s(²S)5f	5f ¹F°	3	57204.22	
3p²	3p² ³P	0	57812.72	
		1	57833.28	20.56
		2	57873.89	40.61
3s(²S)7s	7s ³S	1	57853.5	
3s(²S)7s	7s ¹S	0	58009.46	
3s(²S)6d	6d ¹D	2	58023.27	
3s(²S)6d	6d ³D	3, 2, 1	58442.62	
3s(²S)7p	7p ³P°	0, 1, 2	58478.4	
3s(²S)6f	6f ³F°	2, 3, 4	58575.54	
3s(²S)6f	6f ¹F°	3	58575.54	
3s(²S)8s	8s ³S	1	58962.49	
3s(²S)7d	7d ¹D	2	59041.09	

Mg I

Config.	Desig.	J	Level	Interval
3s(²S)7d	7d ³D	3, 2, 1	59317.4	
3s(²S)7f	7f ³F°	2, 3, 4	59400.77	
3s(²S)7f	7f ¹F°	3	59400.77	
3s(²S)9s	9s ³S	1	59648.2	
3s(²S)8d	8d ¹D	2	59690.02	
3s(²S)8d	8d ³D	3, 2, 1	59880.3	
3s(²S)8f	8f ³F°	2, 3, 4	59935.38	
3s(²S)8f	8f ¹F°	3	59935.38	
3s(²S)10s	10s ³S	1	60103.5	
3s(²S)9d	9d ¹D	2	60127.31	
3s(²S)9d	9d ³D	3, 2, 1	60263.0	
3s(²S)9f	9f ³F°	2, 3, 4	60301.30	
3s(²S)9f	9f ¹F°	3	60301.30	
3s(²S)11s	11s ³S	1	60420.2	
3s(²S)10d	10d ¹D	2	60435.15	
3s(²S)10d	10d ³D	3, 2, 1	60534.5	
3s(²S)10f	10f ³F°	2, 3, 4	60562.64	
3s(²S)10f	10f ¹F°	3	60562.64	
3s(²S)12s	12s ³S	1	60649.2	
3s(²S)11d	11d ¹D	2	60658.37	
3s(²S)11d	11d ³D	3, 2, 1	60734.0	
3s(²S)11f	11f ³F°	2, 3, 4	60755.78	
3s(²S)11f	11f ¹F°	3	60755.78	
3s(²S)13s	13s ³S	1	60820.9	
3s(²S)12d	12d ¹D	2	60826.6	
3s(²S)12d	12d ³D	3, 2, 1	60884.8	
3s(²S)12f	12f ³F°	2, 3, 4	60902.53	
3s(²S)12f	12f ¹F°	3	60902.53	
3s(²S)14s	14s ³S	1	60952.0	
3s(²S)13d	13d ¹D	2	60955.8	
3s(²S)13d	13d ³D	3, 2, 1	61002.2	
3s(²S)13f	13f ¹F°	3	61016.42	
3s(²S)14d	14d ³D	3, 2, 1	61094.6	
3s(²S)14f	14f ¹F°	3	61106.98	
--------	--------	--------	--------	
Mg II (²S½)	*Limit*		**61669.14**	
3p(²P°)3d	3d ¹F°	3	80693.2	
3p(²P°)3d	3d ³D°	1	83510.73	
		2	83519.98	9.25
		3	83536.22	16.24

July 1947.

Mg I Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms			
$3s^2$	$3s^2\,{}^1S$			
$3s({}^2S)\,3p$	$\{$	$3p\,{}^3P^\circ$ $3p\,{}^1P^\circ$		
$3p^2$	$3p^2\,{}^3P$			
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$	$nf\ (n\geq 4)$
$3s({}^2S)\,nx$	$\{$ 4–14s ${}^3S$ 4– 7s ${}^1S$	4–7p ${}^3P^\circ$ 4, 5p ${}^1P^\circ$	3–14d ${}^3D$ 3–13d ${}^1D$	4–12f ${}^3F^\circ$ 4–14f ${}^1F^\circ$
$3p({}^2P^\circ)\,nx$	$\{$		3d ${}^3D^\circ$ 3d ${}^1F^\circ$	

*For predicted terms in the spectra of the Mg I isoelectronic sequence, see Introduction.

Mg II

(Na I sequence; 11 electrons) $\qquad\qquad$ $Z=12$

Ground state $1s^2\,2s^2\,2p^6\,3s\,{}^2S_{\frac{1}{2}}$

$3s\,{}^2S_{\frac{1}{2}}$ **121267.41** cm^{-1} $\qquad\qquad$ I. P. 15.03 volts

The analysis is from Fowler and Paschen-Götze. Mundie and Meissner calculate the separation of $3d\,{}^2D$ to be 1.000 ± 0.002 cm^{-1} (entered in brackets in the table). In 1913 A. S. King observed the line at 4481 A ($3d\,{}^2D-4f\,{}^2F^\circ$) as double, the violet component being about twice as strong as the red, thus indicating that the term $3d\,{}^2D$ is inverted.

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H. E. White, *Introduction to Atomic Spectra*, p. 98 (McGraw-Hill Book Co., Inc., New York, N. Y., 1934). (G D)
L. G. Mundie and K. W. Meissner, Phys. Rev. **65**, 272 (1944). (I S)

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
3s	3s ²S	½	0.00		7d	7d ²D	1½ 2½	112198.0	
3p	3p ²P°	½ 1½	35669.42 35760.97	91.55	7f	7f ²F°	2½ 3½	112301.8	
4s	4s ²S	½	69805.19		7g	7g ²G	3½ 4½	112310.2	
3d	3d ²D	2½ 1½	71490.41 71491.32	[−1.000]	9s	9s ²S	½	114292.2	
4p	4p ²P°	½ 1½	80620.8 80651.3	30.5	8d	8d ²D	1½ 2½	114335.7	
5s	5s ²S	½	92786.2		8f	8f ²F°	2½ 3½	114403.6	
4d	4d ²D	1½ 2½	93312.1		8g	8g ²G	3½ 4½	114408.6	
4f	4f ²F°	2½ 3½	93800.0		9f	9f ²F°	2½ 3½	115845.1	
5p	5p ²P°	½ 1½	97454.9 97469.0	14.1	9g	9g ²G	3½ 4½	115848.6	
6s	6s ²S	½	103198.1		10f	10f ²F°	2½ 3½	116875.7	
5d	5d ²D	1½ 2½	103421.1		10g	10g ²G	3½ 4½	116878.2	
5f	5f ²F°	2½ 3½	103690.2		11f	11f ²F°	2½ 3½	117638.3	
6p	6p ²P°	½ 1½	105623.1 105630.7	7.6	11g	11g ²G	3½ 4½	117640.6	
7s	7s ²S	½	108784.7		12f	12f ²F°	2½ 3½	118218.5	
6d	6d ²D	1½ 2½	108900.9		12g	12g ²G	3½ 4½	118220.2	
6f	6f ²F°	2½ 3½	109062.6						
6g	6g ²G	3½ 4½	109073.2		Mg III (¹S₀)	*Limit*	———	**121267.41**	
8s	8s ²S	½	112129.8						

May 1947.

Mg III

(Ne I sequence; 10 electrons) $Z=12$

Ground state $1s^2\, 2s^2\, 2p^6\, {}^1S_0$

$2p^6\, {}^1S_0$ **646364** cm⁻¹   I. P. 80.12 volts

    The analysis has been taken from Söderqvist's Monograph. The term designations he assigns on the assumption of LS-coupling are given with his notation under the heading "Author" in the table.

    As for Ne I, the jl-coupling notation is introduced in the general form suggested by Racah. Shortley has, however, pointed out that the configurations $2p^5\, 3s$, $2p^5\, 3p$, and $2p^5\, 3d$ are much closer to LS-coupling than to jl-coupling.

<div align="center">REFERENCES</div>

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 7, 22 (1934). (I P) (T) (C L) (G D).
G. Racah, Phys. Rev. **61**, 537 (L) (1942).
G. Shortley, unpublished material (1948).

Mg III

Author	Config.	Desig.	J	Level	Author	Config.	Desig.	J	Level
$2p$ $^1S_0$	$2p^6$	$2p^6\ ^1S$	0	0.0	$4d$ $^3P_1$	$2p^5(^2P^\circ_{1\frac12})4d$	$4d\ [\ \frac12]^\circ$	0 / 1	581747
$3s$ $^3P_2$ / $^3P_1$	$2p^5(^2P^\circ_{1\frac12})3s$	$3s\ [1\frac12]^\circ$	2 / 1	425649.1 / 426877.0	$4d$ $^1P_1$	$''$	$4d\ [1\frac12]^\circ$	1	583448
$3s$ $^3P_0$ / $^1P_1$	$2p^5(^2P^\circ_{\frac12})3s$	$3s'[\ \frac12]^\circ$	0 / 1	427861.1 / 431539.0	$4d$ $^3D_1$	$2p^5(^2P^\circ_{\frac12})4d$	$4d'[1\frac12]^\circ$	2 / 1	585473
$3p_{10}$ $^3S_1$	$2p^5(^2P^\circ_{1\frac12})3p$	$3p\ [\ \frac12]$	1	467387.3	$5s$ $^3P_1$	$2p^5(^2P^\circ_{1\frac12})5s$	$5s\ [1\frac12]^\circ$	2 / 1	589116
$3p_9$ $^3D_3$ / $3p_8$ $^3D_2$	$''$	$3p\ [2\frac12]$	3 / 2	474062.6 / 474663.6	$5s$ $^1P_1$	$2p^5(^2P^\circ_{\frac12})5s$	$5s'[\ \frac12]^\circ$	0 / 1	591191
$3p_7$ $^3D_1$ / $3p_6$ $^1D_2$	$''$	$3p\ [1\frac12]$	1 / 2	475511.4 / 477444.9	$5d$ $^3P_1$	$2p^5(^2P^\circ_{1\frac12})5d$	$5d\ [\ \frac12]^\circ$	0 / 1	605345
$3p_3$ $^3P_0$	$''$	$3p\ [\ \frac12]$	0	479275.3	$5d$ $^1P_1$	$''$	$5d\ [1\frac12]^\circ$	1	606230
$3p_5$ $^1P_1$ / $3p_4$ $^3P_2$	$2p^5(^2P^\circ_{\frac12})3p$	$3p'[1\frac12]$	1 / 2	478383.8 / 478855.5	$5d$ $^3D_1$	$2p^5(^2P^\circ_{\frac12})5d$	$5d'[1\frac12]^\circ$	2 / 1	608332
$3p_2$ $^3P_1$ / $3p_1$ $^1S_0$	$''$	$3p'[\ \frac12]$	1 / 0	479465.4 / 484439.3	$6s$ $^3P_1$	$2p^5(^2P^\circ_{1\frac12})6s$	$6s\ [1\frac12]^\circ$	2 / 1	609166
$3d$ $^3P_0$ / $^3P_1$	$2p^5(^2P^\circ_{1\frac12})3d$	$3d\ [\ \frac12]^\circ$	0 / 1	530186.4 / 530429.5	$6s$ $^1P_1$	$2p^5(^2P^\circ_{\frac12})6s$	$6s'[\ \frac12]^\circ$	0 / 1	611299
$3d$ $^3P_2$	$''$	$3d\ [1\frac12]^\circ$	2	530972.0	$6d$ $^1P_1$	$2p^5(^2P^\circ_{1\frac12})6d$	$6d\ [1\frac12]^\circ$	1	618483
$3d$ $^3F_4$ / $^3F_3$	$''$	$3d\ [3\frac12]^\circ$	4 / 3	531569.9 / 531838.5	$6d$ $^3D_1$	$2p^5(^2P^\circ_{\frac12})6d$	$6d'[1\frac12]^\circ$	2 / 1	620598
$3d$ $^3F_2$ / $^1F_3$	$''$	$3d\ [2\frac12]^\circ$	2 / 3	532731.8 / 532978.0	$7d$ $^1P_1$	$2p^5(^2P^\circ_{1\frac12})7d$	$7d\ [1\frac12]^\circ$	1	625958
$3d$ $^1P_1$	$''$	$3d\ [1\frac12]^\circ$	1	534204.1	$7d$ $^3D_1$	$2p^5(^2P^\circ_{\frac12})7d$	$7d'[1\frac12]^\circ$	2 / 1	628105
$3d$ $^1D_2$ / $^3D_3$	$2p^5(^2P^\circ_{\frac12})3d$	$3d'[2\frac12]^\circ$	2 / 3	534782.2 / 534931.0	$8d$ $^1P_1$	$2p^5(^2P^\circ_{1\frac12})8d$	$8d\ [1\frac12]^\circ$	1	630795
$3d$ $^3D_2$ / $^3D_1$	$''$	$3d'[1\frac12]^\circ$	2 / 1	535185.9 / 536156.7					
$4s$ $^3P_1$	$2p^5(^2P^\circ_{1\frac12})4s$	$4s\ [1\frac12]^\circ$	2 / 1	546529	Mg IV $(^2P^\circ_{1\frac12})$		*Limit*	------	**646364**
$4s$ $^1P_1$	$2p^5(^2P^\circ_{\frac12})4s$	$4s'[\ \frac12]^\circ$	0 / 1	548727	Mg IV $(^2P^\circ_{\frac12})$		*Limit*	------	648590

July 1947.

Mg III Observed Levels*

Config. $1s^2\,2s^2+$	Observed Terms		
$2p^6$	$2p^6\ {}^1S$		
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2p^5({}^2P^\circ)nx$	$\{$ $\quad$ 3–6s $\ {}^3P^\circ$ $\quad$ 3–6s $\ {}^1P^\circ$	$3p\ {}^3S$ $\quad$ $3p\ {}^3P$ $\quad$ $3p\ {}^3D$ $\qquad$ $3p\ {}^1S$ $\quad$ $3p\ {}^1P$ $\quad$ $3p\ {}^1D$	3–5d ${}^3P^\circ$ $\quad$ 3–7d ${}^3D^\circ$ $\quad$ $3d\ {}^3F^\circ$ $\qquad$ 3–8d ${}^1P^\circ$ $\quad$ $3d\ {}^1D^\circ$ $\quad$ $3d\ {}^1F^\circ$

jl-Coupling Notation

	Observed Pairs		
	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2p^5({}^2P^\circ_{1\frac12})nx$	3–6s $[1\frac12]^\circ$	$3p\ [\ \frac12]$ $\quad$ $3p\ [2\frac12]$ $\quad$ $3p\ [1\frac12]$	3–5d $[\ \frac12]^\circ$ $\quad$ $3d\ [3\frac12]^\circ$ $\quad$ 3–8d $[1\frac12]^\circ$ $\quad$ $3d\ [2\frac12]^\circ$
$2p^5({}^2P^\circ_{\frac12})nx'$	3–6s' $[\ \frac12]^\circ$	$3p'\ [1\frac12]$ $\quad$ $3p'\ [\ \frac12]$	$3d'\ [2\frac12]^\circ$ $\quad$ 3–7d' $[1\frac12]^\circ$

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

Mg IV

(F I sequence; 9 electrons) $\hspace{6cm}$ $Z=12$

Ground state $1s^2\,2s^2\,2p^5\ {}^2P^\circ_{1\frac12}$

$2p^5\ {}^2P^\circ_{1\frac12}$ *881759* cm^{-1} $\hspace{5cm}$ I. P. 109.29 volts

The analysis is by Söderqvist, who has classified more than 70 lines, 13 in the interval 1459 A to 1956 A, and the rest between 123 A and 323 A.

From later isoelectronic sequence data Robinson has revised Söderqvist's $3d'\ {}^2S$ and $4d\ {}^2D$ terms, rejected his $3d\ {}^4D$ term, and added $3d\ {}^2F$; 3, $4d\ {}^4P$; $3d\ {}^4F$, and $3d'\ {}^2F$. These revisions have been incorporated into the table.

Intersystem combinations connecting the doublet and quartet systems of terms, have been observed.

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 7, 39 (1934). (I P) (T) (C L)
H. A. Robinson, unpublished material (March 1948). (T) (C L)

Config.	Desig.	J	Level	Interval
$2s^2\,2p^5$	$2p^5\ ^2P°$	$1\frac{1}{2}$ $\frac{1}{2}$	*0* *2226*	−2226
$2s\ 2p^6$	$2p^6\ ^2S$	$\frac{1}{2}$	311527	
$2s^2\,2p^4(^3P)3s$	$3s\ \ ^4P$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	543727. 0 545143. 5 545962. 1	−1416. 5 −818. 6
$2s^2\,2p^4(^3P)3s$	$3s\ \ ^2P$	$1\frac{1}{2}$ $\frac{1}{2}$	553659 555338	−1679
$2s^2\,2p^4(^1D)3s$	$3s'\ \ ^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	582571 582589	−18
$2s^2\,2p^4(^3P)3p$	$3p\ \ ^4P°$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	*596527. 3* *597071. 9* *597589. 9*	−544. 6 −518. 0
$2s^2\,2p^4(^3P)3p$	$3p\ \ ^4D°$	$3\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	*603143. 3* *604007. 4* *604666. 6*	−864. 1 −659. 2
$2s^2\,2p^4(^3P)3p$	$3p\ \ ^4S°$	$1\frac{1}{2}$	*612240. 3*	
$2s^2\,2p^4(^1S)3s$	$3s''\ ^2S$	$\frac{1}{2}$	624102	
$2s^2\,2p^4(^3P)3d$	$3d\ \ ^4P$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	676837 677805	−968
$2s^2\,2p^4(^3P)3d$	$3d\ \ ^4F$	$4\frac{1}{2}$ $3\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$	677355	
$2s^2\,2p^4(^3P)3d$	$3d\ \ ^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	678403 680030	−1627
$2s^2\,2p^4(^3P)3d$	$3d\ \ ^2F$	$3\frac{1}{2}$ $2\frac{1}{2}$	680510	
$2s^2\,2p^4(^3P)3d$	$3d\ \ ^2P$	$\frac{1}{2}$ $1\frac{1}{2}$	681024 682471	1447

Config.	Desig.	J	Level	Interval
$2s^2\,2p^4(^1D)3d$	$3d'\ \ ^2P$	$\frac{1}{2}$ $1\frac{1}{2}$	711622 711865	243
$2s^2\,2p^4(^1D)3d$	$3d'\ \ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	712120 713389	1269
$2s^2\,2p^4(^1D)3d$	$3d'\ \ ^2F$	$3\frac{1}{2}$ $2\frac{1}{2}$	713660	
$2s^2\,2p^4(^1D)3d$	$3d'\ \ ^2S$	$\frac{1}{2}$	714330	
$2s^2\,2p^4(^3P)4s$	$4s\ \ ^2P$	$1\frac{1}{2}$ $\frac{1}{2}$	723254 724809	−1555
$2s^2\,2p^4(^1S)3d$	$3d''\ ^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	752927 752965	−38
$2s^2\,2p^4(^3P)4d$	$4d\ \ ^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	767454 770799	−3345
$2s^2\,2p^4(^3P)4d$	$4d\ \ ^4P$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	767769 768728	959
$2s^2\,2p^4(^3P)4d$	$4d\ \ ^2P$	$\frac{1}{2}$ $1\frac{1}{2}$	769397 770056	659
$2s^2\,2p^4(^1S)4s$	$4s''\ ^2S$	$\frac{1}{2}$	797062	
$2s^2\,2p^4(^1D)4d$	$4d'\ \ ^2P$	$\left\{\begin{matrix}\frac{1}{2}\\1\frac{1}{2}\end{matrix}\right\}$	802272	
$2s^2\,2p^4(^1D)4d$	$4d'\ \ ^2D$	$\left\{\begin{matrix}1\frac{1}{2}\\2\frac{1}{2}\end{matrix}\right\}$	803023	
$2s^2\,2p^4(^1D)4d$	$4d'\ \ ^2S$	$\frac{1}{2}$	803769	
$2s^2\,2p^4(^3P)5d$	$5d\ \ ^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	809677 811362	−1685
$2s^2\,2p^4(^3P)5d$	$5d\ \ ^2P$	$\left\{\begin{matrix}\frac{1}{2}\\1\frac{1}{2}\end{matrix}\right\}$	810543	
Mg v ($^3P_2$)	*Limit*	-------	*881759*	

Mg IV OBSERVED TERMS*

Config. $1s^2+$	Observed Terms			
$2s^2\,2p^5$	$2p^5\ ^2P°$			
$2s\ 2p^6$	$2p^6\ ^2S$			
	$ns\ (n\ge3)$	$np\ (n\ge3)$	$nd\ (n\ge3)$	

Config. $1s^2+$	$ns\ (n\ge3)$	$np\ (n\ge3)$	$nd\ (n\ge3)$
$2s^2\,2p^4(^3P)nx$	$\left\{\begin{matrix}3s\ \ ^4P\\3,4s\ \ ^2P\end{matrix}\right.$	$3p\ ^4S°\quad 3p\ ^4P°\quad 3p\ ^4D°$	$3,4d\ ^4P\qquad 3d\ ^4F$ $3\text{–}5d\ ^2P\quad 3\text{–}5d\ ^2D\quad 3d\ ^2F$
$2s^2\,2p^4(^1D)nx'$	$3s'\ ^2D$		$3,4d'\ ^2S\quad 3,4d'\ ^2P\quad 3,4d'\ ^2D\quad 3d'\ ^2F$
$2s^2\,2p^4(^1S)nx''$	$3,4s''\ ^2S$		$3d''\,^2D$

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

Mg V

(O I sequence; 8 electrons) $Z=12$

Ground state $1s^2\,2s^2\,2p^4\,{}^3P_2$

$2p^4\,{}^3P_2$ **1139421** cm⁻¹   I. P. 141.23 volts

Söderqvist has found 53 terms and classified 113 lines in this spectrum in the interval between 92 A and 355 A.   No intersystem combinations have been observed and the uncertainty, x, may be considerable.

<div align="center">REFERENCE</div>

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **32A**, No. 19 p. 4 (1946).   (I P) (T) (C L)

Mg V

Author		Config.	Desig.		J	Level	Interval
2p	³P₂	2s² 2p⁴	2p⁴	³P	2	0	−1780
	³P₁				1	1780	−739
	³P₀				0	2519	
2p	¹D₂	2s² 2p⁴	2p⁴	¹D	2	36348+x	
2p	¹S₀	2s² 2p⁴	2p⁴	¹S	0	77712+x	
2p'	³P₂	2s 2p⁵	2p⁵	³P°	2	283211	−1616
	³P₁				1	284827	−881
	³P₀				0	285708	
2p'	¹P₁	2s 2p⁵	2p⁵	¹P°	1	397906+x	
3s	³S₁	2s² 2p³(⁴S°)3s	3s	³S°	1	684544	
3̄s̄	³D₃	2s² 2p³(²D°)3s	3s'	³D°	3	727718	−45
	³D₂				2	727763	−24
	³D₁				1	727787	
3̄s̄	¹D₂	2s² 2p³(²D°)3s	3s'	¹D°	2	735976+x	
3̄s̄		2s² 2p³(²P°)3s	3s''	³P°	0		
	³P₁				1	756536	
	³P₂				2	756589	53
3̄s̄	¹P₁	2s² 2p³(²P°)3s	3s''	¹P°	1	765049+x	
3d	³D₁	2s² 2p³(⁴S°)3d	3d	³D°	1	821963	14
	³D₂				2	821977	94
	³D₃				3	822071	
3̄d̄	³D	2s² 2p³(²D°)3d	3d'	³D°	1, 2, 3	871221	
3̄d̄	¹P₁	2s² 2p³(²D°)3d	3d'	¹P°	1	873862+x	
3̄d̄	³P₂	2s² 2p³(²D°)3d	3d'	³P°	2	876762	−482
	³P₁				1	877244	−200
	³P₀				0	877444	
3̄d̄	¹D₂	2s² 2p³(²D°)3d	3d'	¹D°	2	878028+x	
3̄d̄	³S₁	2s² 2p³(²D°)3d	3d'	³S°	1	879485	
3̄d̄	¹F₃	2s² 2p³(²D°)3d	3d'	¹F°	3	883210+x	
3̄d̄	³P₀	2s² 2p³(²P°)3d	3d''	³P°	0	898673	231
	³P₁				1	898904	387
	³P₂				2	899291	
3̄d̄	¹D₂	2s² 2p³(²P°)3d	3d''	¹D°	2	901872+x	

Mg V

Author		Config.	Desig.		J	Level	Interval
3̄d̄	³D₃	2s² 2p³(²P°)3d	3d''	³D°	3	902047	−394
	³D₂				2	902441	−241
	³D₁				1	902682	
3̄d̄	¹P₁	2s² 2p³(²P°)3d	3d''	¹P°	1	902907+x	
3̄d̄	¹F₃	2s² 2p³(²P°)3d	3d''	¹F°	3	905211+x	
4s	³S₁	2s² 2p³(⁴S°)4s	4s	³S°	1	910639	
3s'	³P₂	2s 2p⁴(⁴P)3s	3s'''	³P	2	940455	−593
	³P₁				1	941048	
					0		
4̄s̄	³D	2s² 2p³(²D°)4s	4s'	³D°	3, 2, 1	962027	
4d	³D₁	2s² 2p³(⁴S°)4d	4d	³D°	1	962378	17
	³D₂				2	962395	32
	³D₃				3	962427	
4̄s̄	¹D₂	2s² 2p³(²D°)4s	4s'	¹D°	2	965189+x	
4̄s̄	³P	2s² 2p³(²P°)4s	4s''	³P°	0, 1, 2	990599	
4̄s̄	¹P₁	2s² 2p³(²P°)4s	4s''	¹P°	1	993795+x	
5s	³S₁	2s² 2p³(⁴S°)5s	5s	³S°	1	1002125	
4̄d̄	³D	2s² 2p³(²D°)4d	4d'	³D°	1, 2, 3	1013878	
4̄d̄	¹P₁	2s² 2p³(²D°)4d	4d'	¹P°	1	1015981+x	
4̄d̄	³P₂	2s² 2p³(²D°)4d	4d'	³P°	2	1017590	−382
	³P₁				1	1017972	
					0		
4̄d̄	¹D₂	2s² 2p³(²D°)4d	4d'	¹D°	2	1018840+x	
4̄d̄	¹F₃	2s² 2p³(²D°)4d	4d'	¹F°	3	1019913+x	
3̄s̄'	³D₁	2s 2p⁴(²D)3s	3sᴵⱽ	³D	1	1020311	64
	³D₂				2	1020375	93
	³D₃				3	1020468	
3p'	³D	2s 2p⁴(⁴P)3p	3p'''	³D°	1, 2, 3	1026283	
5d	³D	2s² 2p³(⁴S°)5d	5d	³D°	1, 2, 3	1026774	
4̄d̄	³P₁	2s² 2p³(²P°)4d	4d''	³P°	0		
	³P₂				1	1042481	200
					2	1042681	

Mg V—Continued

Author	Config.	Desig.	J	Level	Interval
$\overline{\overline{4d}}$ ³D	2s² 2p³(²P°)4d	4d'' ³D°	1, 2, 3	*1043818*	
$\overline{\overline{4d}}$ ¹D₂	2s² 2p³(²P°)4d	4d'' ¹D°	2	*1045766+x*	
$\overline{\overline{4d}}$ ¹P₁	2s² 2p³(²P°)4d	4d'' ¹P°	1	*1046201+x*	
$\overline{\overline{4d}}$ ¹F₃	2s² 2p³(²P°)4d	4d'' ¹F°	3	*1046625+x*	
$\overline{\overline{5s}}$ ³D	2s² 2p³(²D°)5s	5s' ³D°	3, 2, 1	*1054921*	
3d' ³D	2s 2p⁴(⁴P)3d	3d''' ³D	1, 2, 3	1075102	
$\overline{\overline{5d}}$ ³D	2s² 2p³(²D°)5d	5d' ³D°	1, 2, 3	*1079431*	
$\overline{\overline{5d}}$ ³P₂ ³P₁	2s² 2p³(²D°)5d	5d' ³P°	2, 1, 0	*1081883* *1082146*	−263

Mg V—Continued

Author	Config.	Desig.	J	Level	Interval
$\overline{\overline{5d}}$ ¹D₂	2s² 2p²(²D°)5d	5d' 'D°	2	*1082461+x*	
$\overline{\overline{5d}}$ ¹F₃	2s² 2p³(²D°)5d	5d' ¹F°	3	*1082855+x*	
$\overline{\overline{5d}}$ ¹D₂	2s² 2p³(²P°)5d	5d'' ¹D°	2	*1110358+x*	
Mg VI (⁴S°₁½)		*Limit*	------	**1139421**	
4s' ³P₂	2s 2p⁴(⁴P)4s	4s''' ³P	2 1 0	1161768	
3d' ³D₃ ³D₂ ³D₁	2s 2p⁴(²D)3d	3dIV ³D	3 2 1	1166471 1166552 1166626	−81 −74
5s' ³P₂	2s 2p⁴(⁴P)5s	5s''' ³P	2 1 0	1250956	

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Mg V Observed Terms*

Config. 1s²+	Observed Terms		
2s² 2p⁴	2p⁴ ¹S 2p⁴ ³P 2p⁴ ¹D		
2s 2p⁵	2p⁵ ³P° 2p⁵ ¹P°		

	ns (n≥3)	np (n≥3)	nd (n≥3)
2s² 2p³(⁴S°)nx	3–5s ³S°		3–5d ³D°
2s² 2p³(²D°)nx'	3–5s' ³D° 3, 4s' ¹D°		3d' ³S° 3–5d' ³P° 3–5d' ³D° 3, 4d' ¹P° 3–5d' ¹D° 3–5d' ¹F°
2s² 2p³(²P°)nx''	3, 4s'' ³P° 3, 4s'' ¹P°		3, 4d'' ³P° 3, 4d'' ³D° 3, 4d'' ¹F° 3, 4d'' ¹P° 3–5d'' ¹D°
2s 2p⁴(⁴P)nx'''	3–5s''' ³P	3p''' ³D°	3d''' ³D
2s 2p⁴(²D)nxIV	3sIV ³D		3dIV ³D

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

Mg VI

(N I sequence; 7 electrons)   Z=12

Ground state 1s² 2s² 2p³ ⁴S°₁½

2p³ ⁴S°₁½ *1507520* cm⁻¹   I. P. 186.86 volts

The analysis is by Söderqvist, who has found 56 terms and classified 124 lines in the range 72 A to 403 A. No intersystem combinations have been observed. The observations indicate an evident typographical error in the published absolute value of 2p⁴ ²P, which has been corrected. The series are short and the uncertainty, x, may be considerable.

REFERENCE

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **32A,** No. 19 p. 4 (1946). (I P) (T) (C L)

Mg VI **Mg VI**

Author	Config.	Desig.	J	Level	Interval
$2p$ $^4S_2$	$2s^2\,2p^3$	$2p^3$ $^4S°$	$1\frac{1}{2}$	0	
$2p$ $^2D_3$ $^2D_2$	$2s^2\,2p^3$	$2p^3$ $^2D°$	$2\frac{1}{2}$ $1\frac{1}{2}$	$54150+x$ $54171+x$	-21
$2p$ $^2P_1$ $^2P_2$	$2s^2\,2p^3$	$2p^3$ $^2P°$	$\frac{1}{2}$ $1\frac{1}{2}$	$82710+x$ $82832+x$	122
$2p'$ $^4P_3$ $^4P_2$ $^4P_1$	$2s\,2p^4$	$2p^4$ ^4P	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	247945 249578 250445	-1633 -867
$2p'$ $^2D_3$ $^2D_2$	$2s\,2p^4$	$2p^4$ ^2D	$2\frac{1}{2}$ $1\frac{1}{2}$	$340551+x$ $340584+x$	-33
$2p'$ $^2S_1$	$2s\,2p^4$	$2p^4$ ^2S	$\frac{1}{2}$	$400619+x$	
$2p'$ $^2P_2$ $^2P_1$	$2s\,2p^4$	$2p^4$ ^2P	$1\frac{1}{2}$ $\frac{1}{2}$	$423981+x$ $425938+x$	-1957
$3s$ $^4P_1$ $^4P_2$ $^4P_3$	$2s^2\,2p^2(^3P)3s$	$3s$ ^4P	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	893943 894887 896443	944 1556
$3s$ $^2P_1$ $^2P_2$	$2s^2\,2p^2(^3P)3s$	$3s$ ^2P	$\frac{1}{2}$ $1\frac{1}{2}$	$907202+x$ $909096+x$	1894
$\overline{3s}$ ^2D	$2s^2\,2p^2(^1D)3s$	$3s'$ ^2D	$\{1\frac{1}{2}$ / $2\frac{1}{2}\}$	$937628+x$	
$\overline{\overline{3s}}$ $^2S_1$	$2s^2\,2p^2(^1S)3s$	$3s''$ ^2S	$\frac{1}{2}$	$982218+x$	
$3d$ $^2P_2$ $^2P_1$	$2s^2\,2p^2(^3P)3d$	$3d$ ^2P	$1\frac{1}{2}$ $\frac{1}{2}$	$1038855+x$ $1039472+x$	-617
$3d$ $^4D_{23}$ $^4D_1$	$2s^2\,2p^2(^3P)3d$	$3d$ ^4D	$3\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	1045205 1045620	-415
$3d$ $^2F_3$ $^2F_4$	$2s^2\,2p^2(^3P)3d$	$3d$ ^2F	$2\frac{1}{2}$ $3\frac{1}{2}$	$1045212+x$ $1047179+x$	1967
$3s'$ $^4S_2$	$2s\,2p^3(^5S°)3s$	$3s'''$ $^4S°$	$1\frac{1}{2}$	1046634	
$3d$ $^4P_3$ $^4P_2$ $^4P_1$	$2s^2\,2p^2(^3P)3d$	$3d$ ^4P	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	1047307 1047987 1048383	-680 -396
$3d$ $^2D_2$ $^2D_3$	$2s^2\,2p^2(^3P)3d$	$3d$ ^2D	$1\frac{1}{2}$ $2\frac{1}{2}$	$1060848+x$ $1061411+x$	563
$\overline{3d}$ $^2F_4$ $^2F_3$	$2s^2\,2p^2(^1D)3d$	$3d'$ ^2F	$3\frac{1}{2}$ $2\frac{1}{2}$	$1082132+x$ $1082438+x$	-306
$\overline{3d}$ $^2D_2$ $^2D_3$	$2s^2\,2p^2(^1D)3d$	$3d'$ ^2D	$1\frac{1}{2}$ $2\frac{1}{2}$	$1085361+x$ $1085718+x$	357
$\overline{3d}$ $^2P_1$ $^2P_2$	$2s^2\,2p^2(^1D)3d$	$3d'$ ^2P	$\frac{1}{2}$ $1\frac{1}{2}$	$1092558+x$ $1093046+x$	488

Author	Config.	Desig.	J	Level	Interval
$\overline{3d}$ $^2S_1$	$2s^2\,2p^2(^1D)3d$	$3d'$ ^2S	$\frac{1}{2}$	$1097978+x$	
$3p'$ ^4P	$2s\,2p^3(^5S°)3p$	$3p'''$ ^4P	$\{\frac{1}{2}$ to $2\frac{1}{2}\}$	1100146	
$\overline{3s'}$ ^4D	$2s\,2p^3(^3D°)3s$	$3s^{IV}$ $^4D°$	$\{\frac{1}{2}$ to $3\frac{1}{2}\}$	1122023	
$\overline{\overline{3d}}$ ^2D	$2s^2\,2p^2(^1S)3d$	$3d''$ ^2D	$\{1\frac{1}{2}$ / $2\frac{1}{2}\}$	$1123683+x$	
$\overline{3s'}$ ^2D	$2s\,2p^3(^3D°)3s$	$3s^{IV}$ $^2D°$	$\{1\frac{1}{2}$ / $2\frac{1}{2}\}$	$1149638+x$	
$\overline{\overline{3s'}}$ ^4P	$2s\,2p^3(^3P°)3s$	$3s^V$ $^4P°$	$\{\frac{1}{2}$ to $2\frac{1}{2}\}$	1172608	
$3d'$ ^4D	$2s\,2p^3(^5S°)3d$	$3d'''$ $^4D°$	$\{\frac{1}{2}$ to $3\frac{1}{2}\}$	1175396	
$\overline{\overline{3s'}}$ $^2P_1$ $^2P_2$	$2s\,2p^3(^3P°)3s$	$3s^V$ $^2P°$	$\frac{1}{2}$ $1\frac{1}{2}$	$1191126+x$ $1191432+x$	306
	$2s^2\,2p^2(^3P)4s$	$4s$ ^4P	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	 1196740	
$4s$ $^4P_3$					
$4s$ $^2P_2$	$2s^2\,2p^2(^3P)4s$	$4s$ ^2P	$\frac{1}{2}$ $1\frac{1}{2}$	$1198265+x$	
$3p'$ $^2F_4$ $^2F_3$	$2s\,2p^3(^3D°)3p$	$3p^{IV}$ ^2F	$3\frac{1}{2}$ $2\frac{1}{2}$	$1222074+x$ $1222709+x$	-635
$\overline{4s}$ ^2D	$2s^2\,2p^2(^1D)4s$	$4s'$ ^2D	$\{1\frac{1}{2}$ / $2\frac{1}{2}\}$	$1234487+x$	
$4d$ $^4D_{23}$ $^4D_1$	$2s^2\,2p^2(^3P)4d$	$4d$ ^4D	$3\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	1248829 1249500	-671
$4d$ $^2F_3$ $^2F_4$	$2s^2\,2p^2(^3P)4d$	$4d$ ^2F	$2\frac{1}{2}$ $3\frac{1}{2}$	$1251503+x$ $1253148+x$	1645
$4d$ $^4P_3$ $^4P_2$ $^4P_1$	$2s^2\,2p^2(^3P)4d$	$4d$ ^4P	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	1252238 1252662 1252866	-424 -204
$4d$ $^2D_3$	$2s^2\,2p^2(^3P)4d$	$4d$ ^2D	$1\frac{1}{2}$ $2\frac{1}{2}$	$1257189+x$	
$\overline{3d'}$ $^4P_3$ $^4P_2$ $^4P_1$	$2s\,2p^3(^3D°)3d$	$3d^{IV}$ $^4P°$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	1282028 1282398 1282668	-370 -270

Mg VI—Continued

Author	Config.	Desig.	J	Level	Interval
$\overline{3d}'$ ^{4}D	$2s\ 2p^3(^3D^\circ)3d$	$3d^{IV}$ $^4D^\circ$	½ to 3½	}1287044	
$\overline{4d}$ ^{2}F	$2s^2\ 2p^2(^1D)4d$	$4d'$ ^{2}F	3½ 2½	}1287104+x	
$\overline{3d}'$ ^{4}S$_2$	$2s\ 2p^3(^3D^\circ)3d$	$3d^{IV}$ $^4S^\circ$	1½	1287889	
$\overline{3d}'$ ^{2}F$_4$ ^{2}F$_3$	$2s\ 2p^3(^3D^\circ)3d$	$3d^{IV}$ $^2F^\circ$	3½ 2½	1288400+x 1289261+x	−861
$\overline{4d}$ ^{2}D	$2s2p^2(^1D)4d$	$4d'$ ^{2}D	1½ 2½	}1289787+x	
$\overline{4d}$ ^{2}P	$2s^2\ 2p^2(^1D)4d$	$4d'$ ^{2}P	½ 1½	}1292939+x	
$\overline{4d}$ ^{2}S$_1$	$2s^2\ 2p^2(^1D)4d$	$4d'$ ^{2}S	½	1295321+x	
$5s$ ^{4}P$_2$ ^{4}P$_3$	$2s^2\ 2p^2(^3P)5s$	$5s$ ^{4}P	½ 1½ 2½	1317697 1318670	973
$4s'$ ^{4}S$_2$	$2s\ 2p^3(^5S^\circ)4s$	$4s'''$ $^4S^\circ$	1½	1323609	
$\overline{\overline{4d}}$ ^{2}D	$2s^2\ 2p^2(^1S)4d$	$4d''$ ^{2}D	1½ 2½	}1332285+x	
$4p'$ ^{4}P	$2s\ 2p^3(^5S^\circ)4p$	$4p'''$ ^{4}P	½ to 2½	}1340950	

Mg VI—Continued

Author	Config.	Desig.	J	Level	Interval
$5d$ ^{4}D$_{23}$	$2s^2\ 2p^2(^3P)5d$	$5d$ ^{4}D	3½ 2½ 1½ ½	}1342985	
$5d$ ^{2}F$_3$ ^{2}F$_4$	$2s^2\ 2p^2(^3P)5d$	$5d$ ^{2}F	2½ 3½	1344310+x 1346056+x	1746
$5d$ ^{4}P$_3$	$2s^2\ 2p^2(^3P)5d$	$5d$ ^{4}P	2½ 1½ ½	1345550	
$4d'$ ^{4}D	$2s\ 2p^3(^5S^\circ)4d$	$4d'''$ $^4D^\circ$	1½ to 3½	}1373760	
$6s$ ^{4}P$_3$	$2s^2\ 2p^2(^3P)6s$	$6s$ ^{4}P	½ 1½ 2½	1380643	
$\overline{5d}$ ^{2}F	$2s^2\ 2p^2(^1D)5d$	$5d'$ ^{2}F	3½ 2½	}1381572+x	
$\overline{5d}$ ^{2}D	$2s^2\ 2p^2(^1D)5d$	$5d'$ ^{2}D	1½ 2½	}1383088+x	
$5d'$ ^{4}D	$2s\ 2p^3(^5S^\circ)5d$	$5d'''$ $^4D^\circ$	½ to 3½	}1463928	
Mg VII (^{3}P$_0$)	Limit		------	1507520	

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Mg VI Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\ 2p^3$	{ $2p^3$ $^4S^\circ$ $\quad$ $2p^3$ $^2P^\circ$ $\quad$ $2p^3$ $^2D^\circ$		
$2s\ 2p^4$	{ $2p^4$ ^{2}S $\quad$ $2p^4$ ^{4}P / $2p^4$ ^{2}P $\quad$ $2p^4$ ^{2}D		

	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$
$2s^2\ 2p^2(^3P)nx$	{ 3–6s ^{4}P / 3, 4s ^{2}P		3–5d ^{4}P $\quad$ 3–5d ^{4}D / 3d ^{2}P $\quad$ 3, 4d ^{2}D $\quad$ 3–5d ^{2}F
$2s^2\ 2p^2(^1D)nx'$	3, 4s' ^{2}D		3, 4d' ^{2}S $\quad$ 3, 4d' ^{2}P $\quad$ 3–5d' ^{2}D $\quad$ 3–5d' ^{2}F
$2s^2\ 2p^2(^1S)nx''$	3s'' ^{2}S		3, 4d'' ^{2}D
$2s\ 2p^3(^5S^\circ)nx'''$	3, 4s''' $^4S^\circ$	3, 4p''' ^{4}P	3–5d''' $^4D^\circ$
$2s\ 2p^3(^3D^\circ)nx^{IV}$	{ 3s^{IV} $^4D^\circ$ / 3s^{IV} $^2D^\circ$	3p^{IV} ^{2}F	3d^{IV} $^4S^\circ$ $\quad$ 3d^{IV} $^4P^\circ$ $\quad$ 3d^{IV} $^4D^\circ$ $\quad$ 3d^{IV} $^2F^\circ$
$2s\ 2p^3(^3P^\circ)nx^V$	{ 3s^V $^4P^\circ$ / 3s^V $^2P^\circ$		

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

Mg VII

(C I sequence; 6 electrons) $Z=12$

Ground state $1s^2\,2s^2\,2p^2\ ^3P_0$

$2p^2\ ^3P_0$ **1817734** cm^{-1} I. P. 225.31 volts

Söderqvist has found 56 terms and classified 114 lines in this spectrum in the range 58 A to 434 A. He determines the relative values of the singlet, triplet, and quintet systems of terms from the series limits.

Söderqvist gives the quintet term $2p^3\ ^5S^\circ_2$ at 118134 cm^{-1} above the ground state zero. From isoelectronic sequence data Robinson estimates this value as 118620 cm^{-1}. The later value has been used in the table and all quintet terms adjusted accordingly.

The uncertainties x and y may be considerable.

REFERENCES

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **32A**, No. 19 p. 4 (1946). (I P) (T) (C L)
H. A. Robinson, unpublished material (March 1948). (T)

Mg VII

Author		Config.	Desig.		J	Level	Interval
$2p$	$^3P_0$	$2s^2\,2p^2$	$2p^2$	^3P	0	0	1127
	$^3P_1$				1	1127	1812
	$^3P_2$				2	2939	
$2p$	$^1D_2$	$2s^2\,2p^2$	$2p^2$	^1D	2	$41459+x$	
$2p$	$^1S_0$	$2s^2\,2p^2$	$2p^2$	^1S	0	$85647+x$	
$2p'$	$^5S_2$	$2s\,2p^3$	$2p^3$	$^5S^\circ$	2	$118620+y$	
$2p'$	$^3D_3$	$2s\,2p^3$	$2p$	$^3D^\circ$	3	232865	-110
	$^3D_2$				2	232975	-52
	$^3D_1$				1	233027	
$2p'$	^3P	$2s\,2p^3$	$2p^3$	$^3P^\circ$	2, 1, 0	274922	
$2p'$	$^1D_2$	$2s\,2p^3$	$2p^3$	$^1D^\circ$	2	$354923+x$	
$2p'$	$^3S_1$	$2s\,2p^3$	$2p^3$	$^3S^\circ$	1	362128	
$2p'$	$^1P_1$	$2s\,2p^3$	$2p^3$	$^1P^\circ$	1	$397655+x$	
$3s$	$^3P_0$	$2s^2\,2p(^2P^\circ)3s$	$3s$	$^3P^\circ$	0	1047624	761
	$^3P_1$				1	1048385	2521
	$^3P_2$				2	1050906	
$3s$	$^1P_1$	$2s^2\,2p(^2P^\circ)3s$	$3s$	$^1P^\circ$	1	$1061534+x$	
$3p$	$^3P_0$	$2s^2\,2p(^2P^\circ)3p$	$3p$	^3P	0	1123745	1192
	$^3P_1$				1	1124937	913
	$^3P_2$				2	1125850	
$3d$	$^3F_2$	$2s^2\,2p(^2P^\circ)3d$	$3d$	$^3F^\circ$	2	$1178758+x$	
					3		
					4		
$3s'$	$^5P_1$	$2s\,2p^2(^4P)3s$	$3s$	^5P	1	$1179696+y$	788
	$^5P_2$				2	$1180484+y$	1479
	$^5P_3$				3	$1181963+y$	
$3d$	$^1D_2$	$2s^2\,2p(^2P^\circ)3d$	$3d$	$^1D^\circ$	2	$1181424+x$	

Mg VII

Author		Config.	Desig.		J	Level	Interval
$3d$	$^3D_1$	$2s^2\,2p(^2P^\circ)3d$	$3d$	$^3D^\circ$	1	1191753	432
	$^3D_2$				2	1192185	876
	$^3D_3$				3	1193061	
$3d$	$^3P_2$	$2s^2\,2p(^2P^\circ)3d$	$3d$	$^3P^\circ$	2	1196770	-699
	$^3P_1$				1	1197469	-403
	$^3P_0$				0	1197872	
$3s'$	$^3P_0$	$2s\,2p^2(^4P)3s$	$3s$	^3P	0	1211173	882
	$^3P_1$				1	1212055	1624
	$^3P_2$				2	1213679	
$3d$	$^1F_3$	$2s^2\,2p(^2P^\circ)3d$	$3d$	$^1F^\circ$	3	$1212323+x$	
$3d$	$^1P_1$	$2s^2\,2p(^2P^\circ)3d$	$3d$	$^1P^\circ$	1	$1213297+x$	
$3p'$	$^3S_1$	$2s\,2p^2(^4P)3p$	$3p$	$^3S^\circ$	1	1235329	
$3p'$	$^3D_2$	$2s\,2p^2(^4P)3p$	$3p$	$^3D^\circ$	1		1249
	$^3D_3$				2	1264827	
					3	1266076	
$3p'$	^3P	$2s\,2p^2(^4P)3p$	$3p$	$^3P^\circ$	0, 1, 2	1276520	
$3s''$	^3D	$2s\,2p^2(^2D)3s$	$3s'$	^3D	1, 2, 3	1285196	
$3p''$	^3D	$2s\,2p^2(^2D)3p$	$3p'$	$^3D^\circ$	1, 2, 3	1299244	
$3s''$	$^1D_2$	$2s\,2p^2(^2D)3s$	$3s'$	^1D	2	$1305806+x$	
		$2s\,2p^2(^4P)3d$	$3d$	^5D	0		
					1		
$3d'$	$^5D_{23}$				2	$\Big\}1317618+y$	
					3		
					4		
$3d'$	$^5P_3$	$2s\,2p^2(^4P)3d$	$3d$	^5P	3	$1323222+y$	-667
	$^5P_2$				2	$1323889+y$	-422
	$^5P_1$				1	$1324311+y$	

Mg VII—Continued

Author	Config.	Desig.	J	Level	Interval
$3d'$ $^3P_2$	$2s\,2p^2(^4P)3d$	$3d$ ^3P	2	1324975	
$^3P_1$			1	1326033	−1058
$^3P_0$			0	1326568	−535
$3d'$ $^3F_2$	$2s\,2p^2(^4P)3d$	$3d$ ^3F	2	1333173	
$^3F_3$			3	1334115	942
$^3F_4$			4	1335328	1213
$\overline{3p'}$ $^1F_3$	$2s\,2p^2(^2D)3p$	$3p'$ $^1F^\circ$	3	1350497+x	
$3d'$ $^3D_1$	$2s\,2p^2(^4P)3d$	$3d$ ^3D	1	1350626	
$^3D_2$			2	1350948	322
$^3D_3$			3	1351359	411
$\overline{3p'}$ $^1D_2$	$2s\,2p^2(^2D)3p$	$3p'$ $^1D^\circ$	2	1357681+x	
$\overline{3d'}$ ^3F	$2s\,2p^2(^2D)3d$	$3d'$ ^3F	2, 3, 4	1414307	
$\overline{3d'}$ ^3P	$2s\,2p^2(^2D)3d$	$3d'$ ^3P	0, 1, 2	1420669	
$\overline{3d'}$ $^3D_2$	$2s\,2p^2(^2D)3d$	$3d'$ ^3D	1		
			2	1422040	574
$^3D_3$			3	1422614	
$\overline{3d'}$ $^3S_1$	$2s\,2p^2(^2D)3d$	$3d'$ ^3S	1	1435724	
$\overline{3d'}$ $^1F_3$	$2s\,2p^2(^2D)3d$	$3d'$ ^1F	3	1438863+x	
$\overline{3d'}$ $^1D_2$	$2s\,2p^2(^2D)3d$	$3d'$ ^1D	2	1439116+x	
$4d$ $^1D_2$	$2s^2\,2p(^2P^\circ)4d$	$4d$ $^1D^\circ$	2	1466102+x	
$4d$ $^3D_2$	$2s^2\,2p(^2P^\circ)4d$	$4d$ $^3D^\circ$	1		
			2	1469556	864
$^3D_3$			3	1470420	
	$2s^2\,2p(^2P^\circ)4d$	$4d$ $^3P^\circ$	0		
			1		
$4d$ $^3P_2$			2	1472144	
$4d$ $^1F_3$	$2s^2\,2p(^2P^\circ)4d$	$4d$ $^1F^\circ$	3	1477931+x	
$4d$ $^1P_1$	$2s^2\,2p(^2P^\circ)4d$	$4d$ $^1P^\circ$	1	1478676+x	

Mg VII—Continued

Author	Config.	Desig.	J	Level	Interval
	$2s\,2p^2(^4P)4s$	$4s$ ^5P	1		
			2		
$4s'$ $^5P_3$			3	1549235+y	
	$2s\,2p^2(^4P)4p$	$4p$ $^3D^\circ$	1		
			2		
$4p'$ $^3D_3$			3	1579211	
$5d$ ^3P	$2s^2\,2p(^2P^\circ)5d$	$5d$ $^3P^\circ$	0, 1, 2	1597937	
$4d'$ $^5P_3$	$2s\,2p^2(^4P)4d$	$4d$ ^5P	3	1600167+y	
$^5P_2$			2	1600760+y	−593
$^5P_1$			1	1601134+y	−374
$5d$ $^1F_3$	$2s^2\,2p(^2P^\circ)5d$	$5d$ $^1F^\circ$	3	1600986+x	
$4d'$ $^3F_2$	$2s\,2p^2(^4P)4d$	$4d$ ^3F	2	1604844	
$^3F_3$			3	1605621	777
$^3F_4$			4	1606747	1126
$6d$ ^3P	$2s^2\,2p(^2P^\circ)6d$	$6d$ $^3P^\circ$	0, 1, 2	1665781	
$\overline{4d'}$ ^3F	$2s\,2p^2(^2D)4d$	$4d'$ ^3F	2, 3, 4	1695880	
	$2s\,2p^2(^4P)5p$	$5p$ $^3D^\circ$	1		
			2		
$5p'$ $^3D_3$			3	1717734	
	$2s\,2p^2(^4P)5d$	$5d$ ^5P	1		
			2		
$5d'$ $^5P_3$			3	1727216+y	
	$2s\,2p^2(^4P)5d$	$5d$ ^3F	2		
			3		
$5d'$ $^3F_4$			4	1730140	
	$2s\,2p^2(^4P)6d$	$6d$ ^5P	1		
			2		
$6d'$ $^5P_3$			3	1795347+y	
Mg VIII ($^2P^\circ_{1/2}$)	Limit			1817734	

March 1948.

Mg VII Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^2$	$\{$ $2p^2\,^1S$ $2p^2\,^3P$ $2p^2\,^1D$		
$2s\,2p^3$	$\{$ $2p^3\,^5S^\circ$; $2p^3\,^3S^\circ$ $2p^3\,^3P^\circ$ $2p^3\,^3D^\circ$; $2p^3\,^1P^\circ$ $2p^3\,^1D^\circ$		

Config. $1s^2+$	$ns\ (n\ge 3)$	$np\ (n\ge 3)$	$nd\ (n\ge 3)$
$2s^2\,2p(^2P^\circ)nx$	$3s$ $^3P^\circ$; $3s$ $^1P^\circ$	$3p$ ^3P	3–6d $^3P^\circ$, 3,4d $^3D^\circ$, $3d$ $^3F^\circ$; 3,4d $^1P^\circ$, 3,4d $^1D^\circ$, 3–5d $^1F^\circ$
$2s\,2p^2(^4P)nx$	3,4s ^5P; $3s$ ^3P	$3p$ $^3S^\circ$ $3p$ $^3P^\circ$ 3–5p $^3D^\circ$	3–6d ^5P, $3d$ ^5D; $3d$ ^3P, $3d$ ^3D, 3–5d ^3F
$2s\,2p^2(^2D)nx'$	$3s'$ ^3D; $3s'$ ^1D	$3p'$ $^3D^\circ$; $3p'$ $^1D^\circ$ $3p'$ $^1F^\circ$	$3d'$ ^3S $3d'$ ^3P $3d'$ ^3D, 3,4d' ^3F; $3d'$ ^1D, $3d'$ ^1F

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

Mg VIII

(B I sequence; 5 electrons) $Z=12$

Ground state $1s^2\,2s^2\,2p\ ^2\mathrm{P}^{\circ}_{1/2}$

$2p\ ^2\mathrm{P}^{\circ}_{1/2}\ \textbf{\textit{2145679}}$ cm^{-1} I. P. 265.957 volts

The analysis is by Söderqvist, who has classified 118 lines, all but 9 of which lie between 52A and 97 A. He remarks that the term values of $2p^3\ ^2\mathrm{P}^{\circ}$ and $2p^3\ ^2\mathrm{D}^{\circ}$ need further confirmation, since no combination of these terms with the doublets of the $2p^2$ configuration have been observed. These two terms and those calculated from combinations with them may require a slight adjustment but they are not seriously in error, as compared with the errors of measurement. Apparently the values extrapolated from the law of irregular doublets and those obtained from observed combinations confirm the terms fairly well.

The absolute values of the doublet terms are well determined from the $nd\ ^2\mathrm{D}$ series and $nd\ ^2\mathrm{F}^{\circ}$ series, both of which extend to $n=5$.

The absolute values of the quartet terms are obtained from the $nd\ ^4\mathrm{D}^{\circ}$ series ($n=3,\ 4,\ 5$). No intersystem combinations have been observed, and a small correction x may be needed to connect the doublet and quartet terms.

REFERENCE

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **30A**, No. 11, p. 13 (1944).   (I P) (T) (C L)

Mg VIII

Author		Config.	Desig.		J	Level	Interval	Author	Config.	Desig.		J	Level	Interval
$2p$	$^2\mathrm{P}_1$ $^2\mathrm{P}_2$	$2s^2(^1\mathrm{S})2p$	$2p$	$^2\mathrm{P}^{\circ}$	½ 1½	*0* *3304*	3304	$3p'$ $^2\mathrm{S}_1$	$2s\,2p(^3\mathrm{P}^{\circ})3p$	$3p$	$^2\mathrm{S}$	½	*1460911*	
$2p'$	$^4\mathrm{P}_1$ $^4\mathrm{P}_2$ $^4\mathrm{P}_3$	$2s\,2p^2$	$2p^2$	$^4\mathrm{P}$	½ 1½ 2½	$130598+x$ $131763+x$ $133481+x$	1165 1718	$3d'$ $^4\mathrm{D}_2$ $^4\mathrm{D}_3$ $^4\mathrm{D}_4$	$2s\,2p(^3\mathrm{P}^{\circ})3d$	$3d$	$^4\mathrm{D}^{\circ}$	½ 1½ 2½ 3½	*1476964+x* *1477341+x* *1478182+x*	377 841
$2p'$	$^2\mathrm{D}_3$ $^2\mathrm{D}_2$	$2s\,2p^2$	$2p^2$	$^2\mathrm{D}$	2½ 1½	*232281* *232304*	-23	$3d'$ $^2\mathrm{D}_2$ $^2\mathrm{D}_3$	$2s\,2p(^3\mathrm{P}^{\circ})3d$	$3d$	$^2\mathrm{D}^{\circ}$	1½ 2½	*1478358* *1478706*	348
$2p'$	$^2\mathrm{S}_1$	$2s\,2p^2$	$2p^2$	$^2\mathrm{S}$	½	*298283*		$3d'$ $^4\mathrm{P}_3$ $^4\mathrm{P}_2$ $^4\mathrm{P}_1$	$2s\,2p(^3\mathrm{P}^{\circ})3d$	$3d$	$^4\mathrm{P}^{\circ}$	2½ 1½ ½	*1484449+x* *1485153+x* *1485639+x*	-704 -486
$2p'$	$^2\mathrm{P}_1$ $^2\mathrm{P}_2$	$2s\,2p^2$	$2p^2$	$^2\mathrm{P}$	½ 1½	*318747* *320742*	1995	$\overline{3s'}$ $^2\mathrm{P}$	$2s\,2p(^1\mathrm{P}^{\circ})3s$	$3s'$	$^2\mathrm{P}^{\circ}$	$\left\{\begin{array}{c}½\\1½\end{array}\right\}$	*1486995*	
$2p''$	$^4\mathrm{S}_2$	$2p^3$	$2p^3$	$^4\mathrm{S}^{\circ}$	1½	*414380+x*		$3d'$ $^2\mathrm{F}_3$ $^2\mathrm{F}_4$	$2s\,2p(^3\mathrm{P}^{\circ})3d$	$3d$	$^2\mathrm{F}^{\circ}$	2½ 3½	*1504992* *1507043*	2051
$2p''$	$^2\mathrm{D}_3$ $^2\mathrm{D}_2$	$2p^3$	$2p^3$	$^2\mathrm{D}^{\circ}$	2½ 1½	*465598* *465738*	-140	$3d'$ $^2\mathrm{P}_2$ $^2\mathrm{P}_1$	$2s\,2p(^3\mathrm{P}^{\circ})3d$	$3d$	$^2\mathrm{P}^{\circ}$	1½ ½	*1513099* *1514266*	-1167
$2p''$	$^2\mathrm{P}_1$ $^2\mathrm{P}_2$	$2p^3$	$2p^3$	$^2\mathrm{P}^{\circ}$	½ 1½	*524339* *524486*	147	$\overline{3p'}$ $^2\mathrm{D}_2$ $^2\mathrm{D}_3$	$2s\,2p(^1\mathrm{P}^{\circ})3p$	$3p'$	$^2\mathrm{D}$	1½ 2½	*1548027* *1548851*	824
$3s$	$^2\mathrm{S}_1$	$2s^2(^1\mathrm{S})3s$	$3s$	$^2\mathrm{S}$	½	1210689		$\overline{3p'}$ $^2\mathrm{P}_1$ $^2\mathrm{P}_2$	$2s\,2p(^1\mathrm{P}^{\circ})3p$	$3p'$	$^2\mathrm{P}$	½ 1½	*1549955* *1550564*	609
$3d$	$^2\mathrm{D}_2$ $^2\mathrm{D}_3$	$2s^2(^1\mathrm{S})3d$	$3d$	$^2\mathrm{D}$	1½ 2½	1335863 1336033	170	$\overline{3p'}$ $^2\mathrm{S}_1$	$2s\,2p(^1\mathrm{P}^{\circ})3p$	$3p'$	$^2\mathrm{S}$	½	*1556517*	
$3s'$	$^4\mathrm{P}_1$ $^4\mathrm{P}_2$ $^4\mathrm{P}_3$	$2s\,2p(^3\mathrm{P}^{\circ})3s$	$3s$	$^4\mathrm{P}^{\circ}$	½ 1½ 2½	*1352123+x* *1353279+x* *1355296+x*	1156 2017	$3s''$ $^4\mathrm{P}_1$ $^4\mathrm{P}_2$ $^4\mathrm{P}_3$	$2p^2(^3\mathrm{P})3s$	$3s''$	$^4\mathrm{P}$	½ 1½ 2½	*1588737+x* *1589965+x* *1591973+x*	1228 2008
$3s'$	$^2\mathrm{P}_1$ $^2\mathrm{P}_2$	$2s\,2p(^3\mathrm{P}^{\circ})3s$	$3s$	$^2\mathrm{P}^{\circ}$	½ 1½	*1381466* *1383731*	2265	$\overline{3d'}$ $^2\mathrm{F}$	$2s\,2p(^1\mathrm{P}^{\circ})3d$	$3d'$	$^2\mathrm{F}^{\circ}$	$\left\{\begin{array}{c}2½\\3½\end{array}\right\}$	*1597469*	
$3p'$	$^2\mathrm{P}_1$ $^2\mathrm{P}_2$	$2s\,2p(^3\mathrm{P}^{\circ})3p$	$3p$	$^2\mathrm{P}$	½ 1½	1408371 1409401	1030	$\overline{3d'}$ $^2\mathrm{D}_2$ $^2\mathrm{D}_3$	$2s\,2p(^1\mathrm{P}^{\circ})3d$	$3d'$	$^2\mathrm{D}^{\circ}$	1½ 2½	*1607872* *1608224*	
$3p'$	$^2\mathrm{D}_2$ $^2\mathrm{D}_3$	$2s\,2p(^3\mathrm{P}^{\circ})3p$	$3p$	$^2\mathrm{D}$	1½ 2½	1440561 1442836	2275							

Author	Config.	Desig.	J	Level	Interval	Author	Config.	Desig.	J	Level	Interval
$\overline{3d'}$ ²P	2s 2p(¹P°)3d	3d' ²P°	{ ½ 1½ }	1610669			2s 2p(³P°)4s	4s ⁴P°	½ 1½ 2½		
$\overline{3s''}$ ²D	2p²(¹D)3s	3s''' ²D	{ 1½ 2½ }	1638646		4s' ⁴P₃	2s 2p(³P°)4s			1769549+x	
	2p²(³P)3p	3p'' ⁴D°	½ 1½ 2½			4p' ²P₂	2s 2p(³P°)4p	4p ²P	½ 1½	1814176	
3p'' ⁴D₄			3½	1647050+x		4p' ²D₃	2s 2p(³P°)4p	4p ²D	1½ 2½	1825262	
4s ²S₁	2s²(¹S)4s	4s ²S	½	1647879		4d' ²D	2s 2p(³P°)4d	4d ²D°	{ 1½ 2½ }	1837649	
	2p²(³P)3p	3p'' ⁴P°	½ 1½ 2½			4d' ⁴D	2s 2p(³P°)4d	4d ⁴D°	{ ½ to 3½ }	1838017+x	
3p'' ⁴P₃			2½	1653061+x		4d' ⁴P	2s 2p(³P°)4d	4d ⁴P°	{ ½ to 2½ }	1840084+x	
3p'' ⁴S₂	2p²(³P)3p	3p'' ⁴S°	1½	1674774+x		4d' ²F₃ ²F₄	2s 2p(³P°)4d	4d ²F°	2½ 3½	1846146 1848025	1879
$\overline{3p''}$ ²F	2p²(¹D)3p	3p''' ²F°	{ 2½ 3½ }	1691070		5d ²D₂ ²D₃	2s²(¹S)5d	5d ²D	1½ 2½	1858322 1858419	97
4d ²D₂ ²D₃	2s²(¹S)4d	4d ²D	1½ 2½	1693824 1693835	11	$\overline{4d'}$ ²F	2s 2p(¹P°)4d	4d' ²F°	{ 2½ 3½ }	1964303?	
	2p²(³P)3d	3d'' ²F	2½ 3½			$\overline{4d'}$ ²D	2s 2p(¹P°)4d	4d' ²D°	{ 1½ 2½ }	1968694?	
3d'' ²F₄				1701860		5d' ⁴D	2s 2p(³P°)5d	5d ⁴D°	{ ½ to 3½ }	2002221+x	
3d'' ²D	2p²(³P)3d	3d'' ²D	{ 1½ 2½ }	1703243?		5d' ²F₃ ²F₄	2s 2p(³P°)5d	5d ²F°	2½ 3½	2005261 2006652	1391
$\overline{3p''}$ ²D	2p²(¹D)3p	3p''' ²D°	{ 1½ 2½ }	1708860			2p²(³P)4p	4p'' ⁴D°	½ 1½ 2½		
3d'' ⁴P₃ ⁴P₂ ⁴P₁	2p²(³P)3d	3d'' ⁴P	2½ 1½ ½	1716667+x 1717481+x 1717923+x	−814 −442	4p'' ⁴D₄			3½	2042060+x	
$\overline{3d''}$ ²D	2p²(¹D)3d	3d''' ²D	{ 1½ 2½ }	1733744							
$\overline{3d''}$ ²F	2p²(¹D)3d	3d''' ²F	{ 2½ 3½ }	1751987		Mg IX (¹S₀)	Limit			2145679	
$\overline{3d''}$ ²P₁ ²P₂	2p²(¹D)3d	3d''' ²P	½ 1½	1754593 1755558	965						

October 1946.

Mg VIII Observed Terms*

Config. 1s²+	Observed Terms		
2s²(¹S)2p	2p ²P°		
2s 2p²	{ 2p² ²S 2p² ⁴P 2p² ²P 2p² ²D		
2p³	{ 2p³ ⁴S° 2p³ ²P° 2p³ ²D°		

	ns (n ≥ 3)	np (n ≥ 2)	nd (n ≥ 3)
2s²(¹S)nx	3, 4s ²S		3–5d ²D
2s 2p(³P°)nx	{ 3, 4s ⁴P° 3s ²P°	3p ²S 3, 4p ²P 3, 4p ²D	3, 4d ⁴P° 3–5d ⁴D° 3d ²P° 3, 4d ²D° 3–5d ²F°
2s 2p(¹P°)nx'	3s' ²P°	3p' ²S 3p' ²P 3p' ²D	3d' ²P° 3, 4d' ²D° 3, 4d' ²F°
2p²(³P)nx''	{ 3s'' ⁴P	3p'' ⁴S° 3p'' ⁴P° 3, 4p'' ⁴D°	3d'' ⁴P 3d'' ²D 3d'' ²F
2p²(¹D)nx'''	3s''' ²D	3p''' ²D° 3p''' ²F°	3d''' ²P 3d''' ²D 3d''' ²F

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

Mg IX

(Be I sequence; 4 electrons) $\qquad$ $Z=12$

Ground state $1s^2\,2s^2\,{}^1S_0$

$2s^2\,{}^1S_0$ **2645444** cm^{-1} $\qquad$ I. P. 327.90 volts

Sixty-five lines have been classified by Söderqvist. All but three lie in the range between 46 A and 91 A. No intersystem combinations are known, but the absolute term values are determined from series that are fairly well established. The relative uncertainty, x, is probably a few hundred cm^{-1}.

REFERENCE

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **30A,** No. 11 p. 8 (1944). (I P) (T) (C L)

Mg IX

Author		Config.	Desig.		J	Level	Interval	Author		Config.	Desig.		J	Level	Interval
$2s$	${}^1S_0$	$2s^2$	$2s^2$	${}^1S$	0	0		$3d'$	${}^3P_2$	$2p({}^2P°)3d$	$3d$	${}^3P°$	2	$1815552+x$	-982
									${}^3P_1$				1	$1816534+x$	-528
$2p$	${}^3P_0$	$2s({}^2S)2p$	$2p$	${}^3P°$	0	$140786+x$	1162		${}^3P_0$				0	$1817062+x$	
	${}^3P_1$				1	$141948+x$	2472	$3d'$	${}^1F_3$	$2p({}^2P°)3d$	$3d$	${}^1F°$	3	1834337	
	${}^3P_2$				2	$144420+x$									
$2p$	${}^1P_1$	$2s({}^2S)2p$	$2p$	${}^1P°$	1	271687		$3d'$	${}^1P_1$	$2p({}^2P°)3d$	$3d$	${}^1P°$	1	1841286	
$2p'$	${}^3P_0$	$2p^2$	$2p^2$	${}^3P$	0	$366194+x$	1299	$4p$	${}^1P_1$	$2s({}^2S)4p$	$4p$	${}^1P°$	1	2068680	
	${}^3P_1$				1	$367493+x$	2157	$4d$	${}^3D_1$	$2s({}^2S)4d$	$4d$	${}^3D$	1	$2080274+x$	54
	${}^3P_2$				2	$369650+x$			${}^3D_2$				2	$2080328+x$	50
$2p'$	${}^1D_2$	$2p^2$	$2p^2$	${}^1D$	2	404744			${}^3D_3$				3	$2080378+x$	
$2p'$	${}^1S_0$	$2p^2$	$2p^2$	${}^1S$	0	499444		$4d$	${}^1D_2$	$2s({}^2S)4d$	$4d$	${}^1D$	2	2087888	
$3s$	${}^3S_1$	$2s({}^2S)3s$	$3s$	${}^3S$	1	$1532749+x$				$2p({}^2P°)4p$	$4p$	${}^3D$	1		
$3s$	${}^1S_0$	$2s({}^2S)3s$	$3s$	${}^1S$	0	1558076							2		
$3p$	${}^1P_1$	$2s({}^2S)3p$	$3p$	${}^1P°$	1	1593600		$4p'$	${}^3D_3$				3	$2230056+x$	
$3d$	${}^3D_1$	$2s({}^2S)3d$	$3d$	${}^3D$	1	$1631321+x$	163			$2p({}^2P°)4p$	$4p$	${}^3P$	0		
	${}^3D_2$				2	$1631484+x$	168	$4p'$	${}^3P_2$				1		
	${}^3D_3$				3	$1631652+x$							2	2235683	
$3d$	${}^1D_2$	$2s({}^2S)3d$	$3d$	${}^1D$	2	1654583		$4d'$	${}^1D_2$	$2p({}^2P°)4d$	$4d$	${}^1D°$	2	2240853	
$3s'$	${}^3P_0$	$2p({}^2P°)3s$	$3s$	${}^3P°$	0	$1710478+x$	1094	$4p'$	${}^1D_2$	$2p({}^2P°)4p$	$4p$	${}^1D$	2	2241083	
	${}^3P_1$				1	$1711572+x$	2533			$2p({}^2P°)4d$	$4d$	${}^3D°$	1		
	${}^3P_2$				2	$1714105+x$							2		
								$4d'$	${}^3D_3$				3	$2248572+x$	
$3s'$	${}^1P_1$	$2p({}^2P°)3s$	$3s$	${}^1P°$	1	1742772		$4d'$	${}^3P_2$	$2p({}^2P°)4d$	$4d$	${}^3P°$	2	$2249773+x$	
$3p'$	${}^1P_1$	$2p({}^2P°)3p$	$3p$	${}^1P$	1	1748116							1		
$3p'$	${}^3D_1$	$2p({}^2P°)3p$	$3p$	${}^3D$	1	$1755785+x$	1018						0		
	${}^3D_2$				2	$1756803+x$	2500	$4d'$	${}^1F_3$	$2p({}^2P°)4d$	$4d$	${}^1F°$	3	2256219	
	${}^3D_3$				3	$1759303+x$		$4d'$	${}^1P_1$	$2p({}^2P°)4d$	$4d$	${}^1P°$	1	2258119	
$3p'$	${}^3S_1$	$2p({}^2P°)3p$	$3p$	${}^3S$	1	$1770688+x$		$5d$	${}^3D$	$2s({}^2S)5d$	$5d$	${}^3D$	1, 2, 3	$2285243+x$	
$3p'$	${}^3P_0$	$2p({}^2P°)3p$	$3p$	${}^3P$	0	$1777886+x$	1117	$5d$	${}^1D_2$	$2s({}^2S)5d$	$5d$	${}^1D$	2	2288385	
	${}^3P_1$				1	$1779003+x$	1312	$5d'$	${}^3D, {}^3P$	$2p({}^2P°)5d$	$5d$	${}^3P°, {}^3D°$	0 to 3	$2451942+x$	
	${}^3P_2$				2	$1780315+x$		$5d'$	${}^1F_3$	$2p({}^2P°)5d$	$5d$	${}^1F°$	3	2454176	
$3d'$	${}^1D_2$	$2p({}^2P°)3d$	$3d$	${}^1D°$	2	1789287									
$3p'$	${}^1D_2$	$2p({}^2P°)3p$	$3p$	${}^1D$	2	1795868				Mg x $({}^2S_{1/2})$	*Limit*			2645444	
$3d'$	${}^3D_1$	$2p({}^2P°)3d$	$3d$	${}^3D°$	1	$1807694+x$	493								
	${}^3D_2$				2	$1808187+x$	995								
	${}^3D_3$				3	$1809182+x$									

May 1946.

Config. $1s^2+$	Observed Terms		
$2s^2$	$2s^2$ ¹S		
$2s(^2S)2p$	{	$2p$ ³P° $2p$ ¹P°	
$2p^2$	{$2p^2$ ¹S	$2p^2$ ³P	$2p^2$ ¹D

	ns $(n \geq 3)$	np $(n \geq 3)$	nd $(n \geq 3)$
$2s(^2S)nx$	{$3s$ ³S $3s$ ¹S	$3, 4p$ ¹P°	$3–5d$ ³D $3–5d$ ¹D
$2p(^2P°)nx$	{ $3s$ ³P° $3s$ ¹P°	$3p$ ³S $\quad$ $3, 4p$ ³P $\quad$ $3, 4p$ ³D $3p$ ¹P $\quad$ $3, 4p$ ¹D	$3–5d$ ³P° $\quad$ $3–5d$ ³D° $3, 4d$ ¹P° $\quad$ $3, 4d$ ¹D° $\quad$ $3–5d$ ¹F°

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

Mg X

(Li I sequence; 3 electrons) $\hfill Z=12$

Ground state $1s^2\ 2s$ ²S$_{1/2}$

$2s$ ²S$_{1/2}$ **2963810** cm^{-1} . $\hfill$ I. P. 367.36 volts

The present analysis results from the classification of nine lines in the region 65 A to 44 A. The transition $2s$ ²S$-2p$ ²P° has not been reported. The predicted positions of these lines are at 625 A and 609 A.

Some of the relative levels have been connected by a study of the Rydberg denominators in the isoelectronic sequence rather than by the Ritz combination principle.

REFERENCE

J. Söderqvist, Ark. Mat. Astr. Fys. (Stockholm) **30A**, No. 11, p. 3 (1944). (I P) (T) (C L)

Mg X

Author	Config.	Desig.	J	Level	In-ter-val
2s ²S₁	2s	2s ²S	½	0	
2p ²P₁ ²P₂	2p	2p ²P°	½ 1½	*159929* *163976*	4047
3s ²S₁	3s	3s ²S	½	1682648	
3p ²P₁ ²P₂	3p	3p ²P°	½ 1½	*1726519* *1727832*	1313
3d ²D₂ ²D₃	3d	3d ²D	1½ 2½	1743410 1743880	470
4p ²P₂,₁	4p	4p ²P°	{ ½ 1½ }	*2270148*	
4d ²D₂ ²D₃	4d	4d ²D	1½ 2½	2277182 2277694	512
	Mg XI (¹S₀)	*Limit*	------	2963810	

May 1946.

Mg XI

(He I sequence; 2 electrons) $Z=12$

Ground state $1s^2$ ¹S₀

$1s^2$ ¹S₀ **14209200 ± 2500 cm⁻¹**   I. P. 1761.23 ± 0.31 volts

Flemberg has observed the four leading lines in this spectrum; they lie between 7 A and 9 A. He has calculated absolute term values on the assumption that the P-terms can be represented by a Ritz formula. The fourth line appeared on only one plate and was not used in the calculation of the limit.

The unit adopted by Flemberg, 10^3 cm⁻¹, has here been changed to cm⁻¹.

REFERENCE

H. Flemberg, Ark. Mat. Astr. Fys. (Stockholm) **28A**, No. 18, p. 34 (1942). (I P) (T) (C L)

Mg XI

Config.	Desig.	J	Level
$1s^2$	$1s^2$ ¹S	0	0
1s 2p	2p ¹P°	1	*10907300*
1s 3p	3p ¹P°	1	*12738400*
1s 4p	4p ¹P°	1	*13381100*
1s 5p	5p ¹P°	1	*13680600*
-----	-----	---	--------
Mg XII (²S½)	*Limit*	---	14209200

October 1946.

ALUMINUM

Al I

13 electrons

$Z=13$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\ ^2P^\circ_{1/2}$

$3p\ ^2P^\circ_{1/2}$ *48279.16* cm^{-1}

I. P. 5.984 volts

The earlier analysis has been extended by Paschen and Ritschl, who have derived improved term values and extended the observations in the infrared and ultraviolet.

The terms $3p^2\ ^2P$ and $3p^2\ ^2S$ have been suggested by Bowen and Millikan and by Selwyn, respectively. The only combinations are with $3p\ ^2P^\circ$.

Paschen discusses the possibility that the term here called $3d\ ^2D$ may be $3p^2\ ^2D$, in which case all subsequent members of the ^2D series must have n decreased by one unit.

Intersystem combinations connecting the doublet and quartet terms have been observed.

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W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs)

Al I

Al I

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$3p\ ^2P^\circ$	$\tfrac12$ $1\tfrac12$	*0.00* *112.04*	112.04	$3s^2(^1S)4d$	$4d\ ^2D$	$1\tfrac12$ $2\tfrac12$	38929.42 38933.96	4.54
$3s^2(^1S)4s$	$4s\ ^2S$	$\tfrac12$	25347.69		$3s^2(^1S)5p$	$5p\ ^2P^\circ$	$\tfrac12$ $1\tfrac12$	*40271.98* *40277.92*	5.94
$3s\,3p^2$	$3p^2\ ^4P$	$\tfrac12$ $1\tfrac12$ $2\tfrac12$	29020.32 29066.90 29142.68	46.58 75.78	$3s^2(^1S)4f$	$4f\ ^2F^\circ$	$\{\ \tfrac{2\tfrac12}{3\tfrac12}\ \}$	*41318.74*	
$3s^2(^1S)3d$	$3d\ ^2D$	$1\tfrac12$ $2\tfrac12$	32435.45 32436.79	1.34	$3s^2(^1S)6s$	$6s\ ^2S$	$\tfrac12$	42144.84	
$3s^2(^1S)4p$	$4p\ ^2P^\circ$	$\tfrac12$ $1\tfrac12$	*32949.84* *32965.67*	15.83	$3s^2(^1S)5d$	$5d\ ^2D$	$1\tfrac12$ $2\tfrac12$	42233.72 42237.71	3.99
$3s^2(^1S)5s$	$5s\ ^2S$	$\tfrac12$	37689.32		$3s^2(^1S)6p$	$6p\ ^2P^\circ$	$\tfrac12$ $1\tfrac12$	*43334.95* *43337.77*	2.82

Al I—Continued

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
3s²(¹S)5f	5f ²F°	2½ 3½	43831.08		3s 3p²	3p² ²S	½	51753.0?	
3s²(¹S)6d	6d ²D	1½ 2½	44166.48 44168.88	2.40	3s 3p²	3p² ²P	½ 1½	56643.0? 56727.3?	84.3
3s²(¹S)7s	7s ²S	½	44273.16		3s 3p(³P°)4s	4s ⁴P°	½ 1½ 2½	61691.29 61747.38 61843.41	56.09 96.03
3s²(¹S)7p	7p ²P°	½ 1½	44928.4 44930.4	2.0	3s 3p(³P°)3d	3d ²D°	1½ 2½	67635.3 67663.2	27.9
3s²(¹S)6f	6f ²F°	2½ 3½	45194.65		3s 3p(³P°)3d	3d ²P°	1½ ½	71184.7? 71260.7	−76.0
3s²(¹S)7d	7d ²D	1½ 2½	45344.16 45345.60	1.44	3s 3p(³P°)3d	3d ⁴D°	½ 1½ 2½ 3½	71235.63 71244.38 71260.78 71286.27	8.75 16.40 25.49
3s²(¹S)8s	8s ²S	½	45457.27						
3s²(¹S)7f	7f ²F°	2½ 3½	46015.73		3s 3p(³P°)3d	3d ⁴P°	2½ 1½ ½	72203.77 72250.29 72277.68	−46.52 −27.39
3s²(¹S)8d	8d ²D	1½ 2½	46093.9 46094.27	0.4	3s 3p(³P°)5s	5s ²P°	½ 1½	72979.0 73077.9	98.9
3s²(¹S)9s	9s ²S	½	46184.5						
3s²(¹S)9d	9d ²D	1½ 2½	46593.28 46593.83	0.55	3s 3p(³P°)4d	4d ²P°	½ 1½	76521.8 76553.7	31.9
3s²(¹S)10s	10s ²S	½	46665.7		3s 3p(³P°)6s	6s ²P°	½ 1½	78612.5 78710.5	98.0
3s²(¹S)10d	10d ²D	1½ 2½	46942.3		3s 3p(³P°)5d	5d ²F°	2½ 3½	80158.0 80191.9	33.9
3s²(¹S)11d	11d ²D	1½ 2½	47192.0						
Al II (¹S₀)	Limit	--------	48279.16						

August 1947.

Al I Observed Terms*

Config. 1s² 2s² 2p⁶+	Observed Terms			
3s²(¹S)3p	3p ²P°			
3s 3p²	{ 3p² ²S? 3p² ⁴P / 3p² ²P?			
	ns (n ≥ 4)	np (n ≥ 4)	nd (n ≥ 3)	nf (n ≥ 4)
3s²(¹S)nx	4–10s ²S	4–7p ²P°	3–11d ²D	4–7f ²F°
3s 3p(³P°)nx	{ 4s ⁴P° 5, 6s ²P°		3d ⁴P° 3d ⁴D° 3, 4d ²P° 3d ²D° 5d ²F°	

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

Al II

(Mg I sequence; 12 electrons) $\qquad$ $Z=13$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,{}^1S_0$

$3s^2\,{}^1S_0$ **151860.4$\pm$0.5 cm^{-1}** $\qquad$ I. P. 18.823 volts

Sawyer and Paschen published a detailed analysis in 1927, from which most of the terms have been taken. Since then some revisions and extensions have been made, especially regarding the terms from the $^2P^\circ$ limit in Al III. The spectrum of Al II furnishes an excellent illustration of perturbed series and consequently is discussed in a number of theoretical papers on this subject. For example, Shenstone and Russell remark that one of the two lowest ^1D terms should be $3p^2\,{}^1D$. In accordance with their suggestions the terms labeled by Sawyer and Paschen 3 ^1D, 7 ^3F, and 12 ^1P are here designated $3p^2\,{}^1D$, $3d\,{}^3F^\circ$, and $4s\,{}^1P^\circ$?, respectively. These changes cause a decrease of one unit in the published values of n for all following series members in each of the three series.

In the 1927 paper the higher series members of the ^3P and ^3D series are assigned the J-values of the leading components (2 and 3, respectively). As the term intervals are known to be small, all three J-values for each term are entered in the table on the assumption that the terms are unresolved.

In 1933 Paschen and Ritschl published the detailed hyperfine structure separations they observed for a number of the components of triplet terms. From this paper the three new H-terms have been taken, and also slightly improved values of the terms $4s\,{}^1S$, $6s\,{}^3S$, $8p\,{}^3P^\circ$, $5f\,{}^1F^\circ$, and $5g\,{}^{1,\,3}G$. It has been assumed that the singlet and triplet G-terms and also the singlet and triplet H-terms are coincident, since no multiplicities are assigned to them. Van Vleck and Whitelaw give the theoretical explanation of this for the G–terms.

Intersystem combinations connecting the singlet and triplet systems of terms have been observed.

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W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946).   (Summary hfs)

Al II $\qquad\qquad\qquad\qquad$ **Al II**

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ {}^1S$	0	0. 0		$3s(^2S)4p$	$4p\ {}^3P^\circ$	0	*105424. 3*	14. 1
							1	*105438. 4*	29. 3
$3s(^2S)3p$	$3p\ {}^3P^\circ$	0	*37392. 0*	61. 8			2	*105467. 7*	
		1	*37453. 8*	125. 5	$3s(^2S)4p$	$4p\ {}^1P^\circ$	1	*106918. 2*	
		2	*37579. 3*						
$3s(^2S)3p$	$3p\ {}^1P^\circ$	1	*59849. 7*		$3s(^2S)3d$	$3d\ {}^1D$	2	110087. 5	
$3p^2$	$3p^2\ {}^1D$	2	85479. 0		$3s(^2S)5s$	$5s\ {}^3S$	1	120089. 8	
$3s(^2S)4s$	$4s\ {}^3S$	1	91271. 2		$3s(^2S)5s$	$5s\ {}^1S$	0	121365. 2	
$3p^2$	$3p^2\ {}^3P$	0	94084. 5	62. 3	$3s(^2S)4d$	$4d\ {}^3D$	3	121480. 3	−0. 6
		1	94146. 8	120. 9			2	121480. 9	−0. 3
		2	94267. 7				1	121481. 2	
$3s(^2S)4s$	$4s\ {}^1S$	0	95348. 2		$3s(^2S)4f$	$4f\ {}^3F^\circ$	2	*123415. 9*	2. 1
$3s(^2S)3d$	$3d\ {}^3D$	3	95546. 8	−1. 1			3	*123418. 0*	2. 8
		2	95547. 9	−0. 9			4	*123420. 8*	
		1	95548. 8		$3s(^2S)4f$	$4f\ {}^1F^\circ$	3	*123468. 1*	

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s(^2S)4d$	$4d\ ^1D$	2	124792. 0		$3s(^2S)9s$	$9s\ ^2S$	1	*144524. 3*	
$3s(^2S)5p$	$5p\ ^3P°$	0	*125700. 5*	5. 7	$3s(^2S)8d$	$8d\ ^3D$	3, 2, 1	144638. 9	
		1	*125706. 2*	12. 8	$3s(^2S)9s$	$9s\ ^1S$	0	144641. 9	
		2	*125719. 0*						
$3s(^2S)5p$	$5p\ ^1P°$	1	*125866. 7*		$3s(^2S)8d$	$8d\ ^1D$	2	144780. 2	
$3s(^2S)6s$	$6s\ ^3S$	1	132213. 2		$3s(^2S)8f$	$8f\ ^1F°$	3	*144781. 9*	
$3s(^2S)6s$	$6s\ ^1S$	0	132776. 4		$3s(^2S)9p$	$9p\ ^1P°$	1	*144939. 1*	
$3s(^2S)5d$	$5d\ ^3D$	3	132819. 7	−0. 2	$3s(^2S)8g$	$8g\ ^3G$	3, 4, 5	144964. 7	
		2, 1	132819. 9		$3s(^2S)8g$	$8g\ ^1G$	4	144964. 7	
$3s(^2S)5f$	$5f\ ^3F°$	2	*133435. 0*	5. 4	$3s(^2S)8h$	$8h\ ^3H°$	4, 5, 6	*144990. 0*	
		3	*133440. 4*	6. 9	$3s(^2S)8h$	$8h\ ^1H°$	5	*144990. 0*	
		4	*133447. 3*		$3s(^2S)8f$	$8f\ ^3F°$	2	*145126. 5*	2. 4
$3s(^2S)5f$	$5f\ ^1F°$	3	*133679. 3*				3	*145128. 9*	3. 2
$3s(^2S)5d$	$5d\ ^1D$	2	133914. 1				4	*145132. 1*	
$3s(^2S)5g$	$5g\ ^3G$	3, 4, 5	134181. 2		$3p(^2P°)3d$	$3d\ ^3D°$	1, 2	*145148*	4
$3s(^2S)5g$	$5g\ ^1G$	4	134181. 2				3	*145152*	
$3s(^2S)6p$	$6p\ ^1P°$	1	*134917. 3*		$3s(^2S)9p$	$9p\ ^3P°$	0, 1, 2	*145185?*	
$3s(^2S)6p$	$6p\ ^3P°$	0	*135009. 0*	3. 1	$3p(^2P°)4s$	$4s\ ^3P°$	0	*145773. 9*	58. 7
		1	*135012. 1*	6. 8			1	*145832. 6*	126. 8
		2	*135018. 9*				2	*145959. 4*	
$3s(^2S)7s$	$7s\ ^3S$	1	138496. 7		$3s(^2S)10s$	$10s\ ^3S$	1	146108. 8	
$3s(^2S)6f$	$6f\ ^3F°$	2	*138518. 7*	17. 7	$3s(^2S)9d$	$9d\ ^3D$	3, 2, 1	146185. 0	
		3	*138536. 4*	22. 8	$3s(^2S)10s$	$10s\ ^1S$	0	146190. 1	
		4	*138559. 2*						
$3s(^2S)7s$	$7s\ ^1S$	0	138799. 3		$3s(^2S)9d$	$9d\ ^1D$	2	146274. 4	
$3s(^2S)6d$	$6d\ ^3D$	3, 2, 1	138811. 9		$3s(^2S)9f$	$9f\ ^1F°$	3	*146276. 5*	
$3s(^2S)6f$	$6f\ ^1F°$	3	*139242. 9*		$3s(^2S)10p$	$10p\ ^1P°$	1	*146297. 5*	
$3s(^2S)6d$	$6d\ ^1D$	2	139286. 8		$3s(^2S)9g$	$9g\ ^3G$	3, 4, 5	146414. 5	
$3s(^2S)6g$	$6g\ ^3G$	3, 4, 5	139588. 7		$3s(^2S)9g$	$9g\ ^1G$	4	146414. 5	
$3s(^2S)6g$	$6g\ ^1G$	4	139588. 7		$3s(^2S)9h$	$9h\ ^3H°$	4, 5, 6	*146432. 8*	
$3s(^2S)7p$	$7p\ ^1P°$	1	*139916. 7*		$3s(^2S)9h$	$9h\ ^1H°$	5	*146432. 8*	
$3s(^2S)7p$	$7p\ ^3P°$	0, 1, 2	*140091. 2*		$3s(^2S)9f$	$9f\ ^3F°$	2	*146496. 7*	1. 1
$3p(^2P°)3d$	$3d\ ^3F°$	2	*141082. 4*	25. 1			3	*146497. 8*	1. 4
		3	*141107. 5*	33. 0			4	*146499. 2*	
		4	*141140. 5*		$3s(^2S)10p$	$10p\ ^3P°$	0, 1, 2	*146577?*	
$3s(^2S)8s$	$8s\ ^3S$	1	142179. 8		$3p(^2P°)3d$	$3d\ ^3P°$	0	*146595. 0?*	1. 9
$3s(^2S)8s$	$8s\ ^1S$	0	142360. 8				1	*146596. 9*	2. 4
							2	*146599. 3*	
$3s(^2S)7d$	$7d\ ^3D$	3, 2, 1	142362. 8		$3s(^2S)11s$	$11s\ ^3S$	1	147229. 0	
$3s(^2S)7f$	$7f\ ^1F°$	3	*142601. 6*		$3s(^2S)11p$	$11p\ ^1P°$	1	*147268. 8*	
$3s(^2S)7d$	$7d\ ^1D$	2	142607. 0		$3s(^2S)10d$	$10d\ ^3D$	3, 2, 1	147282. 8	
$3s(^2S)7g$	$7g\ ^3G$	3, 4, 5	142849. 2		$3s(^2S)11s$	$11s\ ^1S$	0	147288. 8	
$3s(^2S)7g$	$7g\ ^1G$	4	142849. 2		$3s(^2S)10d$	$10d\ ^1D$	2	147343. 2	
$3s(^2S)8p$	$8p\ ^1P°$	1	*142958. 9*		$3s(^2S)10f$	$10f\ ^1F°$	3	*147344. 2*	
$3s(^2S)8p$	$8p\ ^3P°$	0, 1, 2	*143170. 0*		$3s(^2S)10g$	$10g\ ^3G$	3, 4, 5	147451. 0	
$3s(^2S)7f$	$7f\ ^3\ F°$	2	*143262. 7*	7. 1	$3s(^2S)10g$	$10g\ ^1G$	4	147451. 0	
		3	*143269. 8*	10. 8	$3s(^2S)10h$	$10h\ ^3H°$	4, 5, 6	*147464. 7*	
		4	*143280. 6*						

Al II—Continued

Config.	Desig.	J	Level	Interval
3s(²S)10h	10h ¹H°	5	*147464.7*	
3s(²S)10f	10f ³F°	2	*147499.8*	0.4
		3	*147500.2*	
		4	*147500.8*	0.6
3s(²S)11p	11p ³P°	0, 1, 2	*147572?*	
3p(²P°)4s?	4s ¹P°	1	*148002.0*	
3s(²S)12s	12s ³S	1	148052.5	
3s(²S)11d	11d ³D	3, 2, 1	148090.0	
3s(²S)12s	12s ¹S	0	148097.1	
3s(²S)11f	11f ¹F°	3	*148132.6*	
3s(²S)11d	11d ¹D	2	148132.7	
3s(²S)11g	11g ³G	3, 4, 5	148217.6	
3s(²S)11g	11g ¹G	4	148217.6	
3s(²S)11f	11f ³F°	2	*148248.7*	0.4
		3	*148249.1*	
		4	*148249.6*	0.5
3s(²S)12p	12p ¹P°	1	*148579.4*	
3s(²S)13s	13s ³S	1	148673.7	
3s(²S)13s	13s ¹S	0	148706.9	
3s(²S)12f	12f ¹F°	3	*148731.6*	
3s(²S)12g	12g ³G	3, 4, 5	148800.4	
3s(²S)12g	12g ¹G	4	148800.4	
3s(²S)12f	12f ³F°	2, 3, 4	*148822.5*	
3s(²S)13p	13p ¹P°	1	*149051.9*	
3s(²S)14s	14s ¹S	0	149179.8	

July 1947.

Al II—Continued

Config.	Desig.	J	Level	Interval
3s(²S)13f	13f ¹F°	3	*149199.2*	
3s(²S)13g	13g ³G	3, 4, 5	149252.9	
3s(²S)13g	13g ¹G	4	149252.9	
3s(²S)13f	13f ³F°	2, 3, 4	*149269.5*	
3s(²S)14p	14p ¹P°	1	*149434.8*	
3s(²S)15s	15s ¹S	0	149554.7	
3s(²S)14f	14f ¹F°	3	*149568.6*	
3s(²S)14f	14f ³F°	2, 3, 4	*149625.5*	
3s(²S)15p	15p ¹P°	1	*149748.0*	
3s(²S)16s	16s ¹S	0	149856.6	
3s(²S)15f	15f ¹F°	3	*149866.2*	
3s(²S)15f	15f ³F°	2, 3, 4	*149913.2*	
3s(²S)16p	16p ¹P°	1	*150007.6*	
3s(²S)16f	16f ¹F°	3	*150109.7*	
3s(²S)16f	16f ³F°	2, 3, 4	*150148.4*	
3s(²S)17f	17f ¹F°	3	*150311.1*	
3s(²S)17f	17f ³F°	2, 3, 4	*150343.5*	
3s(²S)18f	18f ¹F°	3	*150479.7*	
3s(²S)19f	19f ¹F°	3	*150622.2*	
3s(²S)20f	20f ¹F°	3	*150744.1*	
Al III (²S½)	**Limit**	--------	**151860.4**	

Al II Observed Terms*

Config. 1s² 2s² 2p⁶+	Observed Terms			
3s²	3s² ¹S			
3s(²S)3p	{	3p ³P° 3p ¹P°		
3p²	{	3p² ³P 3p² ¹D		
	ns (n ≥ 4)		np (n ≥ 4)	nd (n ≥ 3)
3s(²S)nx	{4–13s ³S {4–16s ¹S		4–11p ³P° 4–16p ¹P°	3–11d ³D 3–11d ¹D
3p(²P°)nx	{	4s ³P° 4s ¹P°?		3d ³P° 3d ³D° 3d ³F°
	nf (n ≥ 4)		ng (n ≥ 5)	nh (n ≥ 6)
3s(²S)nx	{4–17f ³F° {4–20f ¹F°		5–13g ³G 5–13g ¹G	8–10h ³H° 8–10h ¹H°

*For predicted terms in the spectra of the Mg I isoelectronic sequence, see Introduction.

Al III

(Na I sequence; 11 electrons) $Z=13$

Ground state $1s^2\,2s^2\,2p^6\,3s\ {}^2S_{1/2}$

$3s\ {}^2S_{1/2}$ **229453.99** cm^{-1} I. P. 28.44 volts

The analysis is by Paschen.   Three terms, $6s\ {}^2S$, $7s\ {}^2S$ and $7p\ {}^2P°$ are from the paper by Ekefors, who extended the observations in the ultra-violet to 486 A.'

<div align="center">REFERENCES</div>

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E. Ekefors, Zeit. Phys. **51**, 471 (1928).   (T) (C L)

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
3s	3s ²S	½	0. 00		6g	6g ²G	3½ 4½	202001. 32	
3p	3p ²P°	½ 1½	53684. 1 53916. 6	232. 5	6h	6h ²H°	4½ 5½	202007. 32	
3d	3d ²D	2½ 1½	115955. 03 115957. 31	−2. 28	7s	7s ²S	½	202904. 8	
4s	4s ²S	½	126162. 58		7p	7p ²P°	½ 1½	205360	
4p	4p ²P°	½ 1½	143632. 25 143712. 38	80. 13	7d	7d ²D	2½ 1½	208880. 37	
4d	4d ²D	2½ 1½	165785. 26 165786. 54	−1. 28	7f	7f ²F°	2½ 3½	209260. 98	
4f	4f ²F°	2½ 3½	167612. 05 167612. 43	0. 38	7g	7g ²G	3½ 4½	209282. 17	
5s	5s ²S	½	170636. 38		7h	7h ²H°	4½ 5½	209287. 52	
5p	5p ²P°	½ 1½	178430. 49 178469. 64	39. 15	8d	8d ²D	2½ 1½	213741. 42	
5d	5d ²D	2½ 1½	188875. 52		8f	8f ²F°	2½ 3½	213992. 12	
5f	5f ²F°	2½ 3½	189875. 34 189875. 46	0. 12	8g	8g ²G	3½ 4½	214010. 67	
5g	5g ²G	3½ 4½	189927. 76		8h	8h ²H°	4½ 5½	214015. 8	
6s	6s ²S	½	191478. 5		9h	9h ²H°	4½ 5½	217255. 2	
6p	6p ²P°	½ 1½	195620. 94 195641. 53	20. 59	Al IV (¹S₀)	Limit	-------	229453. 99	
6d	6d ²D	2½ 1½	201374. 37						
6f	6f ²F°	2½ 3½	201969. 52						

May 1947.

Al IV

(Ne I sequence; 10 electrons) $Z=13$

Ground state $1s^2\, 2s^2\, 2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ 967783 cm^{-1} I. P. 119.96 volts

The analysis has been taken from Söderqvist's Monograph. The term designations he assigns on the assumption of LS-coupling are given with his notation under the heading "Author" in the table.

As for Ne I, the jl-coupling notation in the general form suggested by Racah is introduced. Shortley has, however, pointed out that the configurations $2p^5\,3s$, $2p^5\,3p$, and $2p^5\,3d$ are much closer to LS-coupling than to jl-coupling.

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J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] 9, No. 7, 34 (1934).   (I P) (T) (C L).
G. Racah, Phys. Rev. 61, 537 (L) (1942).
G. Shortley, unpublished material (1948).

Al IV

Author	Config.	Desig.	J	Level
2p ¹S₀	$2p^6$	$2p^6$ ¹S	0	0
3s ³P₂ / ³P₁	$2p^5(^2P^o_{1\frac12})3s$	3s [1½]°	2 / 1	616646.7 / 618477.5
3s ³P₀ / ¹P₁	$2p^5(^2P^o_{\frac12})3s$	3s' [½]°	0 / 1	619947.7 / 624720.5
3p₁₀ ³S₁	$2p^5(^2P^o_{1\frac12})3p$	3p [½]	1	671635.5
3p₉ ³D₃ / 3p₈ ³D₂	"	3p [2½]	3 / 2	680862.9 / 681686.7
3p₇ ³D₁ / 3p₆ ¹D₂	"	3p [1½]	1 / 2	682869.3 / 685732.8
3p₃ ³P₀	"	3p [½]	0	688313.3
3p₅ ¹P₁ / 3p₄ ³P₂	$2p^5(^2P^o_{\frac12})3p$	3p' [1½]	1 / 2	687456.8 / 687834.7
3p₂ ³P₁ / 3p₁ ¹S₀	"	3p' [½]	1 / 0	688653.0 / 690244.9
3d ³P₀ / ³P₁	$2p^5(^2P^o_{1\frac12})3d$	3d [½]°	0 / 1	759197.4 / 759600.9
3d ³P₂	"	3d [1½]°	2	761015.4
3d ³F₄ / ³F₃	"	3d [3½]°	4 / 3	761694.5 / 762277.1
3d ³F₂ / ¹F₃	"	3d [2½]°	2 / 3	763502.8 / 764304.3
3d ¹P₁	"	3d [1½]°	1	767040.6
3d ³D₃ / ¹D₂	$2p^5(^2P^o_{\frac12})3d$	3d' [2½]°	3 / 2	767351.9 / 767536.2?
3d ³D₂ / ³D₁	"	3d' [1½]°	2 / 1	767756.1 / 770836.1

Author	Config.	Desig.	J	Level
4s ³P₁	$2p^5(^2P^o_{1\frac12})4s$	4s [1½]°	2 / 1	802936
4s ¹P₁	$2p^5(^2P^o_{\frac12})4s$	4s' [½]°	0 / 1	806231
4d ³P₁	$2p^5(^2P^o_{1\frac12})4d$	4d [½]°	0 / 1	851956
4d ¹P₁	"	4d [1½]°	1	855286
4d ³D₁	$2p^5(^2P^o_{\frac12})4d$	4d' [1½]°	2 / 1	858671
5s ³P₁	$2p^5(^2P^o_{1\frac12})5s$	5s [1½]°	2 / 1	871391
5s ¹P₁	$2p^5(^2P^o_{\frac12})5s$	5s' [½]°	0 / 1	874669
5d ³P₁	$2p^5(^2P^o_{1\frac12})5d$	5d [½]°	0 / 1	894614
5d ¹P₁	"	5d [1½]°	1	896138
5d ³D₁	$2p^5(^2P^o_{\frac12})5d$	5d' [1½]°	2 / 1	899281
6d ¹P₁	$2p^5(^2P^o_{1\frac12})6d$	6d [1½]°	1	918215
6d ³D₁	$2p^5(^2P^o_{\frac12})6d$	6d' [1½]°	2 / 1	921362
Al v ($^2P^o_{1\frac12}$)	Limit		-------	967783
Al v ($^2P^o_{\frac12}$)	Limit		-------	971223

April 1947.

Al IV Observed Levels*

Config. $1s^2\,2s^2+$	Observed Terms		
$2p^6$	$2p^6$ ^{1}S		
	ns $(n \geq 3)$	np $(n \geq 3)$	nd $(n \geq 3)$
$2p^5(^2P°)nx$	$\begin{cases} 3\text{–}5s & ^3P° \\ 3\text{–}5s & ^1P° \end{cases}$	$3p$ ^{3}S $\quad$ $3p$ $\quad$ ^{3}P $\quad$ $3p$ ^{3}D $3p$ ^{1}S $\quad$ $3p$ $\quad$ ^{1}P $\quad$ $3p$ ^{1}D	$3\text{–}5d$ ^{3}P° $\quad$ $3\text{–}6d$ $\quad$ ^{3}D° $\quad$ $3d$ ^{3}F° $3\text{–}6d$ ^{1}P° $\quad\quad$ $3d$ $\quad$ ^{1}D° $\quad$ $3d$ ^{1}F°

jl-Coupling Notation

	Observed Pairs		
	ns $(n \geq 3)$	np $(n \geq 3)$	nd $(n \geq 3)$
$2p^5(^2P°_{1\frac{1}{2}})nx$	$3\text{–}5s$ $[1\frac{1}{2}]°$	$3p$ $[\;\frac{1}{2}]$ $3p$ $[2\frac{1}{2}]$ $3p$ $[1\frac{1}{2}]$	$3\text{–}5d$ $[\;\frac{1}{2}]°$ $3d$ $[3\frac{1}{2}]°$ $3\text{–}6d$ $[1\frac{1}{2}]°$ $3d$ $[2\frac{1}{2}]°$
$2p^5(^2P°_{\frac{1}{2}})nx'$	$3\text{–}5s'$ $[\;\frac{1}{2}]°$	$3p'$ $[1\frac{1}{2}]$ $3p'$ $[\;\frac{1}{2}]$	$3d'$ $[2\frac{1}{2}]°$ $3\text{–}6d'$ $[1\frac{1}{2}]°$

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

Al V

(F I sequence; 9 electrons) $\hspace{6cm}$ $Z=13$

Ground state $1s^2\,2s^2\,2p^5\,{}^2P°_{1\frac{1}{2}}$

$2p^5\,{}^2P°_{1\frac{1}{2}}$ **1240600** cm^{-1} $\hspace{5cm}$ I. P. 153.77 volts

The analysis published by Söderqvist in 1934 has been extended by Ferner to include 78 classified lines in the region between 85 A and 281 A. The present list has been compiled from unpublished material kindly furnished by Ferner.

Intersystem combinations connecting the doublet and quartet terms have been observed. All but one of the observed combinations are with the ground term.

Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

By analogy with related spectra in the isoelectronic sequence Robinson has suggested the following changes in Ferner's term assignments:

Ferner	Robinson	Ferner	Robinson
$3d$ ^{4}P$_{2\frac{1}{2}}$	$3d$ ^{2}D$_{2\frac{1}{2}}$	$3d'$ ^{2}S$_{\frac{1}{2}}$	$3d'$ ^{2}P$_{1\frac{1}{2}}$
$3d$ ^{4}D$_{1\frac{1}{2}}$ ^{4}D$_{2\frac{1}{2}}$	$3d$ ^{4}F$_{1\frac{1}{2}}$ $3d$ ^{4}P$_{2\frac{1}{2}}$	$3d'$ ^{2}P$_{1\frac{1}{2}}$	$3d'$ ^{2}D$_{1\frac{1}{2}}$
$3d$ ^{2}D$_{2\frac{1}{2}}$	$3d$ ^{2}F$_{2\frac{1}{2}}$	$3d'$ ^{2}D$_{1\frac{1}{2}}$	$3d'$ ^{2}S$_{\frac{1}{2}}$
$4d$ ^{4}D$_{1\frac{1}{2}}$ ^{4}D$_{2\frac{1}{2}}$	$4d$ ^{4}P$_{1\frac{1}{2}}$ $4d$ ^{2}D$_{2\frac{1}{2}}$	$3d'$ ^{2}D$_{2\frac{1}{2}}$ $4d'$ ^{2}S$_{\frac{1}{2}}$	$3d'$ ^{2}D$_{2\frac{1}{2}}$ ^{2}F$_{2\frac{1}{2}}$ $4d'$ ^{2}P$_{1\frac{1}{2}}$
$4d$ ^{2}D$_{1\frac{1}{2}}$ ^{2}D$_{2\frac{1}{2}}$	$4d$ ^{2}P$_{1\frac{1}{2}}$ $4d$ ^{2}D$_{1\frac{1}{2}}$	$4d'$ ^{2}P$_{1\frac{1}{2}}$ $4d'$ ^{2}P$_{\frac{1}{2}}$ ^{2}S$_{\frac{1}{2}}$*	$4d'$ ^{2}D

*1100620.

He has also suggested a correction of $+1000$ cm^{-1} to Ferner's absolute term values. This correction has been made in the limit quoted here.

Al v—Continued

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E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 57 (1948). (I P) (T) (C L)
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Al v

Author	Config.	Desig.	J	Level	Interval
$2p$ $^2P_2$ $^2P_1$	$2s^2\,2p^5$	$2p^5$ $^2P^\circ$	1½ ½	0 3440	−3440
$2p'$ $^2S_1$	$2s\,2p^6$	$2p^6$ ^2S	½	358810	
$3s$ $^4P_3$ $^4P_2$ $^4P_1$	$2s^2\,2p^4(^3P)3s$	$3s$ ^4P	2½ 1½ ½	751810 753960 755250	−2150 −1290
$3s$ $^2P_2$ $^2P_1$	$2s^2\,2p^4(^3P)3s$	$3s$ ^2P	1½ ½	764240 766790	−2550
$\overline{3s}$ $^2D_3$ $^2D_2$	$2s^2\,2p^4(^1D)3s$	$3s'$ ^2D	2½ 1½	796650 796680	−30
$\overline{\overline{3s}}$ $^2S_1$	$2s^2\,2p^4(^1S)3s$	$3s''$ ^2S	½	843880	
$3d$ $^4D_3$ $^4D_2$	$2s^2\,2p^4(^3P)3d$	$3d$ ^4D	3½ 2½ 1½ ½	919900 920680	−780
$3d$ $^4P_1$ $^4P_2$ $^4P_3$	$2s^2\,2p^4(^3P)3d$	$3d$ ^4P	½ 1½ 2½	921440 922120 922640	680 520
$3d$ $^2F_3$	$2s^2\,2p^4(^3P)3d$	$3d$ ^2F	3½ 2½	923230	
$3d$ $^2D_2$ $^2D_3$	$2s^2\,2p^4(^3P)3d$	$3d$ ^2D	1½ 2½	925430 926400	970
$3d$ $^2P_1$ $^2P_2$	$2s^2\,2p^4(^3P)3d$	$3d$ ^2P	½ 1½	925900 928410	2510
$\overline{3d}$ $^2P_1$ $^2P_2$	$2s^2\,2p^4(^1D)3d$	$3d'$ ^2P	½ 1½	960420 961630	1210
$\overline{3d}$ $^2S_1$	$2s^2\,2p^4(^1D)3d$	$3d'$ ^2S	½	960860	
$\overline{3d}$ $^2D_3$ $^2D_2$	$2s^2\,2p^4(^1D)3d$	$3d'$ ^2D	2½ 1½	962640 963330	−690
$4s$ $^2P_2$ $^2P_1$	$2s^2\,2p^4(^3P)4s$	$4s$ ^2P	1½ ½	1005760 1008040	−2280
$\overline{\overline{3d}}$ $^2D_3$ $^2D_2$	$2s^2\,2p^4(^1S)3d$	$3d''$ ^2D	2½ 1½	1007150 1007290	−140
$\overline{4s}$ $^2D_3$ $^2D_2$	$2s^2\,2p^4(^1D)4s$	$4s'$ ^2D	2½ 1½	1043430 1043480	−50

Al v

Author	Config.	Desig.	J	Level	Interval
$4d$ $^4D_3$ $^4D_2$	$2s^2\,2p^4(^3P)4d$	$4d$ ^4D	3½ 2½ 1½ ½	1062510 1062820	−310
$4d$ $^4P_2$ $^4P_3$	$2s^2\,2p^4(^3P)4d$	$4d$ ^4P	½ 1½ 2½	1063650 1064050	400
$4d$ $^2P_1$ $^2P_2$	$2s^2\,2p^4(^3P)4d$	$4d$ ^2P	½ 1½	1065170 1067770	2600
$4d$ $^2D_2$ $^2D_3$	$2s^2\,2p^4(^3P)4d$	$4d$ ^2D	1½ 2½	1065460 1066610	1150
$\overline{4s}$ $^2S_1$	$2s^2\,2p^4(^1S)4s$	$4s''$ ^2S	½	1089930	
$3s'$ $^2P_2$ $^2P_1$	$2s\,2p^5(^3P^\circ)3s$	$3s'''$ $^2P^\circ$	1½ ½	1096180 1098350	−2170
$\overline{4d}$ $^2P_1$ $^2P_2$	$2s^2\,2p^4(^1D)4d$	$4d'$ ^2P	½ 1½	1101400 1103380	1980
$\overline{4d}$ $^2S_1$	$2s^2\,2p^4(^1D)4d$	$4d'$ ^2S	½	1102540	
$\overline{4d}$ $^2D_3$	$2s^2\,2p^4(^1D)4d$	$4d'$ ^2D	2½ 1½	1103190	
$5d$ $^4D_3$ $^4D_2$	$2s^2\,2p^4(^3P)5d$	$5d$ ^4D	3½ 2½ 1½ ½	1127550 1127730	−180
$5d$ $^2D_2$ $^2D_3$	$2s^2\,2p^4(^3P)5d$	$5d$ ^2D	1½ 2½	1129350 1130900	1550
$5d$ $^2P_1$ $^2P_2$	$2s^2\,2p^4(^3P)5d$	$5d$ ^2P	½ 1½	1129350 1131650	2300
$\overline{\overline{4d}}$ $^2D_3$ $^2D_2$	$2s^2\,2p^4(^1S)4d$	$4d''$ ^2D	2½ 1½	1149160 1149260	−100
$6d$ $^2D_2$ $^2D_3$	$2s^2\,2p^4(^3P)6d$	$6d$ ^2D	1½ 2½	1163850 1165450	1600
$\overline{5d}$ $^2S_1$	$2s^2\,2p^4(^1D)5d$	$5d'$ ^2S	½	1167380	
$\overline{5d}$ $^2P_2$	$2s^2\,2p^4(^1D)5d$	$5d'$ ^2P	½ 1½	1168060	
Al vi $(^3P_2)$		*Limit*	------	*1240600*	

March 1948.

Al V Observed Terms*

Config. 1s²+	Observed Terms		
2s² 2p⁵	2p⁵ ²P°		
2s 2p⁶	2p⁶ ²S		
		ns (n ≥ 3)	nd (n ≥ 3)
2s² 2p⁴(³P)nx	{	3s ⁴P 3, 4s ²P	3, 4d ⁴P 3–5d ⁴D 3–5d ²P 3–6d ²D 3d ²F
2s² 2p⁴(¹D)nx′		3, 4s′ ²D	3–5d′ ²S 3–5d′ ²P 3, 4d′ ²D
2s² 2p⁴(¹S)nx″	3, 4s″ ²S		3, 4d″ ²D
2s 2p⁵(³P°)nx‴		3s‴ ²P°	

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

Al VI

(O I sequence; 8 electrons)   Z=13

Ground state 1s² 2s² 2p⁴ ³P₂

2p⁴ ³P₂ **1536300** cm⁻¹   I. P. 190.42 volts

The analysis is by Ferner, who has extended the earlier work by Söderqvist. He has listed 45 terms and 89 classified lines. The later observations are in the region between 68 A and 113 A. Two intersystem combinations have been observed.

Ferner expresses all level values in units of 10³ cm⁻¹ but for uniformity all values listed below are given in cm⁻¹.

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E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 48 (1948). (I P) (T) (C L)

Al VI

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
2s² 2p⁴	2p⁴ ³P	2 1 0	0 2736 3831	−2736 −1095	2s² 2p³(²P°)3s	3s″ ³P°	0 1 2	 993660 993880	220
2s² 2p⁴	2p⁴ ¹D	2	41600		2s² 2p³(²P°)3s	3s″ ¹P°	1	1003700	
2s² 2p⁴	2p⁴ ¹S	0	88670		2s² 2p³(⁴S°)3d	3d ³D°	1 2 3	1079460 1079490 1079610	30 120
2s 2p⁵	2p⁵ ³P°	2 1 0	323002 325470 326822	−2468 −1352	2s² 2p³(²D°)3d	3d′ ³F°	4 3 2	1132180	
2s 2p⁵	2p⁵ ¹P°	1	451840						
2s² 2p³(⁴S°)3s	3s ³S°	1	913130		2s² 2p³(²D°)3d	3d′ ³D°	3, 2, 1	1134170	
2s² 2p³(²D°)3s	3s′ ³D°	3, 2, 1	961100		2s² 2p³(²D°)3d	3d′ ¹P°	1	1136500	
2s² 2p³(²D°)3s	3s′ ¹D°	2	970790						

Config.	Desig.	J	Level	Interval
2s² 2p³(²D°)3d	3d' ³P°	2 / 1 / 0	1140840 / 1141670 / 1141910	−830 / −240
2s² 2p³(²D°)3d	3d' ¹D°	2	1142220	
2s² 2p³(²D°)3d	3d' ³S°	1	1145020	
2s² 2p³(²D°)3d	3d' ¹F°	3	1150250	
2s² 2p³(²P°)3d	3d'' ³P°	0 / 1 / 2	1164220 / 1164620 / 1165260	400 / 640
2s² 2p³(²P°)3d	3d'' ³F°	4 / 3 / 2	1166530 / 1168690	−2160
2s² 2p³(²P°)3d	3d'' ¹D°	2	1169150	
2s² 2p³(²P°)3d	3d'' ³D°	3 / 2 / 1	1169390 / 1170650	−1260
2s² 2p³(²P°)3d	3d'' ¹P°	1	1171050	
2s² 2p³(²P°)3d	3d'' ¹F°	3	1174450	
2s 2p⁴(⁴P)3s	3s''' ³P	2 / 1 / 0	1204550 / 1205500	−950
2s² 2p³(⁴S°)4s	4s ³S°	1	1218290	
2s² 2p³(²D°)4s	4s' ³D°	3, 2, 1	1274550	
2s² 2p³(²D°)4s	4s' ¹D°	2	1279680	
2s² 2p³(⁴S°)4d	4d ³D°	1, 2, 3	1282960	
2s 2p⁴(²D)3s	3s^IV ³D	3, 2, 1	1293290	

Config.	Desig.	J	Level	Interval
2s² 2p³(²P°)4s	4s'' ¹P°	1	1312070	
2s² 2p³(²D°)4d	4d' ³D°	3, 2, 1	1339480	
2s² 2p³(²D°)4d	4d' ¹P°	1	1341090	
2s² 2p³(²D°)4d	4d' ³P°	2 / 1 / 0	1343320	
2s² 2p³(²D°)4d	4d' ³S°	1	1345030	
2s² 2p³(²D°)4d	4d' ¹D°	2	1345430	
2s² 2p³(²D°)4d	4d' ¹F°	3	1346780	
2s 2p⁴(²S)3s	3s^V ³S	1	1359890	
2s² 2p³(²P°)4d	4d'' ³P°	0 / 1 / 2	1371220	
2s² 2p³(²P°)4d	4d'' ³D°	3 / 2 / 1	1373440 / 1375140	−1700
2s² 2p³(⁴S°)5d	5d ³D°	1, 2, 3	1375250	
2s² 2p³(²P°)4d	4d'' ¹F°	3	1376860	
2s² 2p³(²D°)5s	5s' ¹D°	2	1405220	
2s² 2p³(²P°)5d	5d'' ³P°	0 / 1 / 2	1465780	
2s² 2p³(²P°)5d	5d'' ³D°	3 / 2 / 1	1466990	
Al VII (⁴S°₁½)	Limit	-------	1536300	

February 1947.

Al VI Observed Terms*

Config. 1s²+	Observed Terms		
2s² 2p⁴	{ 2p⁴ ¹S	2p⁴ ³P	2p⁴ ¹D
2s 2p⁵	{ 2p⁵ ³P° / 2p⁵ ¹P°		
	ns (n≥3)	**nd (n≥3)**	
2s² 2p³(⁴S°)nx	3, 4s ³S°	3–5d ³D°	
2s² 2p³(²D°)nx'	{ 3, 4s' ³D° / 3–5s' ¹D°	3, 4d' ³S° 3, 4d' ³P° 3, 4d' ³D° 3d' ³F°	3, 4d' ¹P° 3, 4d' ¹D° 3, 4d' ¹F°
2s² 2p³(²P°)nx''	{ 3s'' ³P° / 3, 4s'' ¹P°	3–5d'' ³P° 3–5d'' ³D° 3d'' ³F°	3d'' ¹P° 3d'' ¹D° 3, 4d'' ¹F°
2s 2p⁴(⁴P)nx'''	3s''' ³P		
2s 2p⁴(²D)nx^IV	3s^IV ³D		
2s 2p⁴(²S)nx^V	3s^V ³S		

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

Al VII

(N I sequence; 7 electrons) $Z=13$

Ground state $1s^2\,2s^2\,2p^3\;{}^4S^\circ_{1\frac{1}{2}}$

$2p^3\;{}^4S^\circ_{1\frac{1}{2}}$ **1951830** cm^{-1} I. P. 241.93 volts

The analysis is from Ferner who kindly furnished his manuscript in advance of publication. He has extended the earlier work by Söderqvist to include 76 classified lines between 58 A and 96 A. One intersystem combination has been observed, but the relative positions of the doublet and quartet terms are determined from the series.

The unit used by Ferner, 10^3 cm^{-1}, has here been changed to cm^{-1}.

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J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 7, 64 (1934).   (T) (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 42 (1948).   (I P) (T) (C L)

Al VII

Author	Config.	Desig.	J	Level	Interval	Author	Config.	Desig.	J	Level	Interval
$2p$ ${}^4S_2$	$2s^2\,2p^3$	$2p^3$ ${}^4S^\circ$	$1\frac{1}{2}$	0		$3d$ ${}^2D_2$ ${}^2D_3$	$2s^2\,2p^2({}^3P)3d$	$3d$ ${}^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	1343710 1344530	820
$2p$ ${}^2D_2$ ${}^2D_3$	$2s^2\,2p^3$	$2p^3$ ${}^2D^\circ$	$1\frac{1}{2}$ $2\frac{1}{2}$	60700 60760	60	$\overline{3d}$ ${}^2F_4$ ${}^2F_3$	$2s^2\,2p^2({}^1D)3d$	$3d'$ ${}^2F$	$3\frac{1}{2}$ $2\frac{1}{2}$	1366720 1367160	−440
$2p$ ${}^2P_1$ ${}^2P_2$	$2s^2\,2p^3$	$2p^3$ ${}^2P^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$	93000 93270	270	$\overline{3d}$ ${}^2D_2$ ${}^2D_3$	$2s^2\,2p^2({}^1D)3d$	$3d'$ ${}^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	1369270 1369960	690
$2p'$ ${}^4P_3$ ${}^4P_2$ ${}^4P_1$	$2s\,2p^4$	$2p^4$ ${}^4P$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	280200 282660 283960	−2460 −1300	$\overline{3d}$ ${}^2P_1$ ${}^2P_2$	$2s^2\,2p^2({}^1D)3d$	$3d'$ ${}^2P$	$\frac{1}{2}$ $1\frac{1}{2}$	1378290 1379130	840
$2p'$ ${}^2D_3$ ${}^2D_2$	$2s\,2p^4$	$2p^4$ ${}^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	384260 384310	−50	$3p'$ ${}^4P$	$2s\,2p^3({}^5S^\circ)3p$	$3p'''$ ${}^4P$	$\left\{\begin{array}{c}\frac{1}{2}\\ \text{to}\\ 2\frac{1}{2}\end{array}\right\}$	1383700	
$2p'$ ${}^2S_1$	$2s\,2p^4$	$2p^4$ ${}^2S$	$\frac{1}{2}$	451360		$\overline{3d}$ ${}^2S_1$	$2s^2\,2p^2({}^1D)3d$	$3d'$ ${}^2S$	$\frac{1}{2}$	1384370	
$2p'$ ${}^2P_2$ ${}^2P_1$	$2s\,2p^4$	$2p^4$ ${}^2P$	$1\frac{1}{2}$ $\frac{1}{2}$	476090 479050	−2960	$\overline{\overline{3d}}$ ${}^2D$	$2s^2\,2p^2({}^1S)3d$	$3d''$ ${}^2D$	$\left\{\begin{array}{c}1\frac{1}{2}\\ 2\frac{1}{2}\end{array}\right\}$	1410380	
$3s$ ${}^4P_1$ ${}^4P_2$ ${}^4P_3$	$2s^2\,2p^2({}^3P)3s$	$3s$ ${}^4P$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	1147100 1148630 1150920	1530 2290	$3d'$ ${}^4D$	$2s\,2p^3({}^5S^\circ)3d$	$3d'''$ ${}^4D^\circ$	$\left\{\begin{array}{c}\frac{1}{2}\\ \text{to}\\ 3\frac{1}{2}\end{array}\right\}$	1473060	
$3s$ ${}^2P_1$ ${}^2P_2$	$2s^2\,2p^2({}^3P)3s$	$3s$ ${}^2P$	$\frac{1}{2}$ $1\frac{1}{2}$	1162360 1165130	2770	$4s$ ${}^4P_2$ ${}^4P_3$	$2s^2\,2p^2({}^3P)4s$	$4s$ ${}^4P$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	1540740 1542850	2110
$\overline{3s}$ ${}^2D$	$2s^2\,2p^2({}^1D)3s$	$3s'$ ${}^2D$	$\left\{\begin{array}{c}1\frac{1}{2}\\ 2\frac{1}{2}\end{array}\right\}$	1196680		$4s$ ${}^2P_2$	$2s^2\,2p^2({}^3P)4s$	$4s$ ${}^2P$	$\frac{1}{2}$ $1\frac{1}{2}$	1540820	
$\overline{\overline{3s}}$ ${}^2S_1$	$2s^2\,2p^2({}^1S)3s$	$3s''$ ${}^2S$	$\frac{1}{2}$	1246840		$\overline{3d'}$ ${}^4P_3$ ${}^4P_2$ ${}^4P_1$	$2s\,2p^3({}^3D^\circ)3d$	$3d^{IV}$ ${}^4P^\circ$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	1591560 1592170 1592550	−610 −380
$3d$ ${}^2P_2$ ${}^2P_1$	$2s^2\,2p^2({}^3P)3d$	$3d$ ${}^2P$	$1\frac{1}{2}$ $\frac{1}{2}$	1315640 1316420	−780	$\overline{3d'}$ ${}^4D$	$2s\,2p^3({}^3D^\circ)3d$	$3d^{IV}$ ${}^4D^\circ$	$\left\{\begin{array}{c}\frac{1}{2}\\ \text{to}\\ 3\frac{1}{2}\end{array}\right\}$	1598270	
$3s'$ ${}^4S_2$	$2s\,2p^3({}^5S^\circ)3s$	$3s'''$ ${}^4S^\circ$	$1\frac{1}{2}$	1322180		$4d$ ${}^2P_2$	$2s^2\,2p^2({}^3P)4d$	$4d$ ${}^2P$	$1\frac{1}{2}$ $\frac{1}{2}$	1598890	
$3d$ ${}^2F_3$ ${}^2F_4$	$2s^2\,2p^2({}^3P)3d$	$3d$ ${}^2F$	$2\frac{1}{2}$ $3\frac{1}{2}$	1323370 1326390	3020	$\overline{3d'}$ ${}^4S_2$	$2s\,2p^3({}^3D^\circ)3d$	$3d^{IV}$ ${}^4S^\circ$	$1\frac{1}{2}$	1599300	
$3d$ ${}^4D_{32}$ ${}^4D_1$	$2s^2\,2p^2({}^3P)3d$	$3d$ ${}^4D$	$3\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	1323940 1324710	−770	$4d$ ${}^4D_{32}$ ${}^4D_1$	$2s^2\,2p^2({}^3P)4d$	$4d$ ${}^4D$	$3\frac{1}{2}$ $2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	1600670 1601740	−1070
$3d$ ${}^4P_3$ ${}^4P_2$ ${}^4P_1$	$2s^2\,2p^2({}^3P)3d$	$3d$ ${}^4P$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	1326960 1327990 1328550	−1030 −560						

Author	Config.	Desig.	J	Level	Interval
4d ²F₃ / ²F₄	$2s^2\,2p^2(^3P)4d$	4d ²F	2½ / 3½	1603550 / 1606260	2710
4d ⁴P₃	$2s^2\,2p^2(^3P)4d$	4d ⁴P	2½ / 1½ / ½	1605240	
4d ²D₂ / ²D₃	$2s^2\,2p^2(^3P)4d$	4d ²D	1½ / 2½	1610820 / 1611560	740
$\overline{4d}$ ²D₂ / ²D₃	$2s^2\,2p^2(^1D)4d$	4d′ ²D	1½ / 2½	1646820 / 1647880	1060
$\overline{4d}$ ²F₃₄	$2s^2\,2p^2(^1D)4d$	4d′ ²F	{ 2½ 3½ }	1647430	
$\overline{4d}$ ²S₁	$2s^2\,2p^2(^1D)4d$	4d′ ²S	½	1654160	

Author	Config.	Desig.	J	Level	Interval
5s ⁴P₃	$2s^2\,2p^2(^3P)5s$	5s ⁴P	½ / 1½ / 2½	1702070	
5d ²F₃ / ²F₄	$2s^2\,2p^2(^3P)5d$	5d ²F	2½ / 3½	1729840 / 1732410	2570
4d′ ⁴D₄ / ⁴D₃ / ⁴D₂₁	$2s\,2p^3(^5S^\circ)4d$	4d‴ ⁴D°	3½ / 2½ / { 1½ ½ }	*1739390* / *1739600* / *1739970*	−210 / −370
$\overline{5d}$ ²F₄₃	$2s^2\,2p^2(^1D)5d$	5d′ ²F	{ 3½ 2½ }	*1773560*	
Al VIII (³P₀)	*Limit*			*1951830*	

March 1947.

Al VII Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^3$	{ $2p^3\ ^4S^\circ$ $2p^3\ ^2P^\circ$ $2p^3\ ^2D^\circ$		
$2s\,2p^4$	{ $2p^4\ ^2S$ $2p^4\ ^4P$ $2p^4\ ^2P$ $2p^4\ ^2D$		
	ns (n ≥ 3)	np (n ≥ 3)	nd (n ≥ 3)
$2s^2\,2p^2(^3P)nx$	{ 3–5s ⁴P 3,4s ²P		3,4d ⁴P 3,4d ⁴D 3,4d ²P 3,4d ²D 3–5d ²F
$2s^2\,2p^2(^1D)nx'$		3s′ ²D	3,4d′ ²S 3d′ ²P 3,4d′ ²D 3–5d′ ²F
$2s^2\,2p^2(^1S)nx''$	3s″ ²S		3d″ ²D
$2s\,2p^3(^5S^\circ)nx'''$	3s‴ ⁴S°	3p‴ ⁴P	3,4d‴ ⁴D°
$2s\,2p^3(^3D^\circ)nx^{IV}$			3d^IV ⁴S° 3d^IV ⁴P° 3d^IV ⁴D°

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

Al VIII

(C I sequence; 6 electrons)   Z=13

Ground state $1s^2\,2s^2\,2p^2\ ^3P_0$

$2p^2\ ^3P_0$ **2300390 cm⁻¹**   I. P. 285.13 volts

The analysis is by Ferner, who has generously furnished his manuscript in advance of publication. He has extended the earlier work by Söderqvist to include 77 classified lines in the region between 53 A and 91 A. The relative values of the singlet, triplet, and quintet systems of terms are determined from the series limits.

Ferner's unit, 10³ cm⁻¹, has here been converted to cm⁻¹.

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E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 37 (1948). (I P) (T) (C L)

Al VIII

Author	Config.	Desig.	J	Level	Interval
2p ³P₀	2s² 2p²	2p² ³P	0	0	1740
³P₁			1	1740	2700
³P₂			2	4440	
2p ¹D₂	2s² 2p²	2p² ¹D	2	46690+x	
2p ¹S₀	2s² 2p²	2p² ¹S	0	96170+x	
2p′ ⁵S₂	2s 2p³	2p³ ⁵S°	2	133510+y	
2p′ ³D₃	2s 2p³	2p³ ³D°	3	262190	−130
³D₂			2	262320	−70
³D₁			1	262390	
2p′ ³P	2s 2p³	2p³ ³P°	0, 1, 2	309130	
2p′ ¹D₂	2s 2p³	2p³ ¹D°	2	396990+x	
2p′ ³S₁	2s 2p³	2p³ ³S°	1	404220	
2p′ ¹P₁	2s 2p³	2p³ ¹P°	1	444550+x	
3s ³P₀	2s² 2p(²P°)3s	3s ³P°	0	1319280	1170
³P₁			1	1320450	3630
³P₂			2	1324080	
3s ¹P₁	2s² 2p(²P°)3s	3s ¹P°	1	1335270+x	
3p ³S₁	2s² 2p(²P°)3p	3p ³S	1	1402180	
3s′ ⁵P₁	2s 2p²(⁴P)3s	3s ⁵P	1	1465810+y	1660
⁵P₂			2	1467470+y	2210
⁵P₃			3	1469680+y	
3d ³F₂	2s² 2p(²P°)3d	3d ³F°	2, 3, 4	1468700+x	
3d ¹D₂	2s² 2p(²P°)3d	3d ¹D°	2	1471980+x	
3d ³D₁	2s² 2p(²P°)3d	3d ³D°	1	1484560	680
³D₂			2	1485240	1470
³D₃			3	1486710	
3d ³P₂	2s² 2p(²P°)3d	3d ³P°	2	1490590	−980
³P₁			1	1491570	−570
³P₀			0	1492140	
3s′ ³P₀	2s 2p²(⁴P)3s	3s ³P	0		
³P₁			1	1504810	2410
³P₂			2	1507220	
3d ¹F₃	2s² 2p(²P°)3d	3d ¹F°	3	1509210+x	
3d ¹P₁	2s² 2p(²P°)3d	3d ¹P°	1	1510060+x	
3p′ ³S₁	2s 2p²(⁴P)3p	3p ³S°	1	1531270	
3p′ ³D₁	2s 2p²(⁴P)3p	3p ³D°	1	1564140	700
³D₂			2	1564840	2000
³D₃			3	1566840	
	2s 2p²(⁴P)3p	3p ³P°	0		
			1		
3p′ ³P₂			2	1577760	
$\overline{3s'}$ ³D	2s 2p²(²D)3s	3s′ ³D	1, 2, 3	1585400	
$\overline{3s'}$ ¹D₂	2s 2p²(²D)3s	3s′ ¹D	2	1608440+x	

Al VIII

Author	Config.	Desig.	J	Level	Interval
3d′ ⁵P₃	2s 2p²(⁴P)3d	3d ⁵P	3	1631170+y	−890
⁵P₂			2	1632060+y	−610
⁵P₁			1	1632670+y	
3d′ ³P₂	2s 2p²(⁴P)3d	3d ³P	2	1633840	−1600
³P₁			1	1635440	
			0		
3d′ ³F₂	2s 2p²(⁴P)3d	3d ³F	2	1643590	1400
³F₃			3	1644990	1800
³F₄			4	1646790	
$\overline{3p'}$ ¹F₃	2s 2p²(²D)3p	3p′ ¹F°	3	1659180+x	
$\overline{\overline{3s'}}$ ³S₁	2s 2p²(²S)3s	3s″ ³S	1	1662740	
3d′ ³D₁	2s 2p²(⁴P)3d	3d ³D	1	1664880	500
³D₂			2	1665380	550
³D₃			3	1665930	
$\overline{3p'}$ ¹D₂	2s 2p²(²D)3p	3p′ ¹D°	2	1667490+x	
	2s 2p²(²P)3s	3s‴ ³P	0		
$\overline{\overline{3s'}}$ ³P₂			1		
			2	1682590	
$\overline{3d'}$ ³F	2s 2p²(²D)3d	3d′ ³F	2, 3, 4	1733950	
$\overline{3d'}$ ³D	2s 2p²(²D)3d	3d′ ³D	1, 2, 3	1742250	
$\overline{3d'}$ ³P₂	2s 2p²(²D)3d	3d′ ³P	2	1745690	−1250
³P₁			1	1747940	−1700
³P₀			0	1749640	
$\overline{3d'}$ ³S₁	2s 2p²(²D)3d	3d′ ³S	1	1762090	
	2s² 2p(²P°)4s	4s ³P°	0		
			1		
4s ³P₂			2	1785380	
$\overline{\overline{3d'}}$ ³D₂	2s 2p²(²S)3d	3d″ ³D	1		
³D₃			2	1815990	960
			3	1816950	
$\overline{\overline{3d'}}$ ³F	2s 2p²(²P)3d	3d‴ ³F	2, 3, 4	1831700	
$\overline{\overline{3d'}}$ ³D	2s 2p²(²P)3d	3d‴ ³D	1, 2, 3	1840570	
	2s 2p²(²P)3d	3d‴ ³P	0		
$\overline{\overline{3d'}}$ ³P₂			1		
			2	1844390	
	2s² 2p(²P°)4d	4d ³D°	1		
4d ³D₂			2	1846180	1310
³D₃			3	1847490	
4d ¹P₁	2s² 2p(²P°)4d	4d ¹P°	1	1853670+x	
4d′ ⁵P₃	2s 2p²(⁴P)4d	4d ⁵P	3	1991450+y	−800
⁵P₂			2	1992250+y	−510
⁵P₁			1	1992760+y	
	2s 2p²(⁴P)4d	4d ³F	2		
4d′ ³F₃			3	1997710	2000
³F₄			4	1999710	
Al IX (²P°₁/₂)	Limit			2300390	

March 1948.

Al VIII Observed Terms*

Config. 1s²+	Observed Terms		
2s² 2p²	{2p² ¹S 2p² ³P 2p² ¹D		
2s 2p³	{2p³ ⁵S° 2p³ ³S° 2p³ ³P° 2p³ ³D° 2p³ ¹P° 2p³ ¹D°		

Config. 1s²+	ns (n ≥ 3)	np (n ≥ 3)	nd (n ≥ 3)
2s² 2p(²P°)nx	{ 3, 4s ³P° 3s ¹P°	3p ³S	3d ³P° 3, 4d ³D° 3d ³F° 3, 4d ¹P° 3d ¹D° 3d ¹F°
2s 2p²(⁴P)nx	{ 3s ⁵P 3s ³P	3p ³S° 3p ³P° 3p ³D°	3, 4d ⁵P 3d ³P 3d ³D 3, 4d ³F
2s 2p²(²D)nx'	{ 3s' ³D 3s' ¹D	3p' ¹D° 3p' ¹F°	3d' ³S 3d' ³P 3d' ³D 3d' ³F
2s 2p²(²S)nx''	3s'' ³S		3d'' ³D
2s 2p²(²P)nx'''	3s''' ³P		3d''' ³P 3d''' ³D 3d''' ³F

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

Al IX

(B I sequence; 5 electrons) $Z = 13$

Ground state $1s^2\, 2s^2\, 2p\ ^2P^\circ_{1/2}$

$2p\ ^2P^\circ_{1/2}$ **2663340** cm⁻¹   I. P. 330.1 volts

    Ferner has extended the preliminary analysis by Söderqvist and now has 74 classified lines in the range between 43 A and 77 A. He kindly furnished his manuscript in advance of publication.

    No intersystem combinations have been observed, as indicated by x in the table, but the absolute values of the doublet and quartet terms are determined from series. The quartet terms are not all connected by observed combinations.

    Ferner's unit, 10³ cm⁻¹, has here been changed to cm⁻¹.

REFERENCE

J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9,** No. 7, 90 (1934). (C L)

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 30 (1948). (I P) (T) (C L)

Al ɪx — Al ɪx

Author	Config.	Desig.	J	Level	Interval	Author	Config.	Desig.	J	Level	Interval
2p ²P₁ ²P₂	2s²(¹S)2p	2p ²P°	½ 1½	*0* *4890*	4890	$\overline{3p'}$ ²D₂ ²D₃	2s 2p(¹P°)3p	3p' ²D	1½ 2½	1875340 1876710	1370
2p' ⁴P₁ ⁴P₂ ⁴P₃	2s 2p²	2p² ⁴P	½ 1½ 2½	146310+x 148000+x 150490+x	1690 2490	$\overline{3p'}$ ²P	2s 2p(¹P°)3p	3p' ²P	{ ½ 1½ }	}1878390	
2p' ²D	2s 2p²	2p² ²D	{ 1½ 2½ }	} 259720		3s'' ⁴P₁ ⁴P₂ ⁴P₃	2p²(³P)3s	3s'' ⁴P	½ 1½ 2½	1917920+x 1918850+x 1921100+x	930 2250
2p' ²S₁	2s 2p²	2p² ²S	½	332650		$\overline{3d'}$ ²F	2s 2p(¹P°)3d	3d' ²F°	{ 2½ 3½ }	}*1933050*	
2p' ²P₁ ²P₂	2s 2p²	2p² ²P	½ 1½	353960 356950	2990	$\overline{3d'}$ ²D₂ ²D₃	2s 2p(¹P°)3d	3d' ²D°	1½ 2½	*1943380* *1943980*	600
2p'' ⁴S₂	2p³	2p³ ⁴S°	1½	*461910+x*		$\overline{3d'}$ ²P	2s 2p(¹P°)3d	3d' ²P°	{ ½ 1½ }	}*1954710*	
2p'' ²D₃ ²D₂	2p³	2p³ ²D°	2½ 1½	*519560* *519740*	−180		2p²(³P)3p	3p'' ⁴D°	½ 1½ 2½ 3½	*1986800+x*	
2p'' ²P₁ ²P₂	2p³	2p³ ²P°	½ 1½	*584150* *584390*	240	3p'' ⁴D₄	2p²(³P)3p	3p'' ⁴P°	½ 1½ 2½	*1991700+x*	
3s ²S₁	2s²(¹S)3s	3s ²S	½	1501020		3p'' ⁴P₃					
3d ²D₂ ²D₃	2s²(¹S)3d	3d ²D	1½ 2½	1642140 1642380	240	3p'' ⁴S₂	2p²(³P)3p	3p'' ⁴S°	1½	*2017670+x*	
3s' ⁴P₁ ⁴P₂ ⁴P₃	2s 2p(³P°)3s	3s ⁴P°	½ 1½ 2½	*1657690+x* *1659350+x* *1662340+x*	1660 2990	$\overline{3p''}$ ²D	2p²(¹D)3p	3p''' ²D°	{ 1½ 2½ }	}*2056120*	
3s' ²P₁ ²P₂	2s 2p(³P°)3s	3s ²P°	½ 1½	*1690880* *1694110*	3230	3d'' ⁴P	2p²(³P)3d	3d'' ⁴P	2½ 1½ ½	2065270+x 2066350+x 2067100+x	−1080 −750
3p' ²P₁ ²P₂	2s 2p(³P°)3p	3p ²P	½ 1½	1720900 1722400	1500	4d ²D₂ ²D₃	2s²(¹S)4d	4d ²D	1½ 2½	2094020 2094490	470
3p' ²D₂ ²D₃	2s 2p(³P°)3p	3p ²D	1½ 2½	1757500 1760970	3470		2s 2p(³P°)4d	4d ⁴D°	½ 1½ 2½ 3½	*2254250+x*	
3p' ²S₁	2s 2p(³P°)3p	3p ²S	½	1780950		4d' ⁴D₄					
3d' ⁴D₁₂ ⁴D₃ ⁴D₄	2s 2p(³P°)3d	3d ⁴D°	{ ½ 1½ 2½ 3½	}*1799090+x* *1799490+x* *1800980+x*	400 1490	4d' ⁴P₃	2s 2p(³P°)4d	4d ⁴P°	2½ 1½ ½	*2256240+x*	
3d' ²D₂ ²D₃	2s 2p(³P°)3d	3d ²D°	1½ 2½	*1800460* *1800910*	450	4d' ²F₄	2s 2p(³P°)4d	4d ²F°	2½ 3½	*2265580*	
$\overline{3s'}$ ²P	2s 2p(¹P°)3s	3s' ²P°	{ ½ 1½ }	}*1807020*		5d ²D₃	2s²(¹S)5d	5d ²D	1½ 2½	2301150	
3d' ⁴P₃ ⁴P₂ ⁴P₁	2s 2p(³P°)3d	3d ⁴P°	2½ 1½ ½	*1807490+x* *1808530+x* *1809210+x*	−1040 −680	$\overline{4d'}$ ²D₃	2s 2p(¹P°)4d	4d' ²D°	1½ 2½	*2393860*	
3d' ²F₃ ²F₄	2s 2p(³P°)3d	3d ²F°	2½ 3½	*1831260* *1834300*	3040		Al x (¹S₀)	*Limit*	-------	*2663340*	
3d' ²P₂ ²P₁	2s 2p(³P°)3d	3d ²P°	1½ ½	*1840470* *1842220*	−1750						

August 1947.

Al IX Observed Terms*

Config. 1s²+	Observed Terms				
$2s^2(^1S)2p$		$2p$ $^2P°$			
$2s\ 2p^2$	$\{2p^2\ ^2S$	$2p^2\ ^4P$ $2p^2\ ^2P$	$2p^2\ ^2D$		
$2p^3$	$\{2p^3\ ^4S°$	$2p^3\ ^2P°$	$2p^3\ ^2D°$		

Config. 1s²+	$ns\ (n\geq 3)$		$np\ (n\geq 3)$		$nd\ (n\geq 3)$
$2s^2(^1S)nx$	$3s$ ^2S				$3\text{–}5d$ ^2D
$2s\ 2p(^3P°)nx$	$\{$ $3s$ $^4P°$ $3s$ $^2P°$		$3p$ ^2S $3p$ ^2P $3p$ ^2D		$3,4d$ $^4P°$ $3,4d$ $^4D°$ $3d$ $^2P°$ $3d$ $^2D°$ $3,4d$ $^2F°$
$2s\ 2p(^1P°)nx'$	$3s'$ $^2P°$		$3p'$ ^2P $3p'$ ^2D		$3d'$ $^2P°$ $3,4d'$ $^2D°$ $3d'$ $^2F°$
$2p^2(^3P)nx''$	$3s''$ ^4P	$3p''$ $^4S°$	$3p''$ $^4P°$ $3p''$ $^4D°$		$3d''$ ^4P
$2p^2(^1D)nx'''$				$3p'''$ $^2D°$	

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

Al X

(Be I sequence; 4 electrons) $Z=13$

Ground state $1s^2\ 2s^2\ ^1S_0$

$2s^2\ ^1S_0$ **3215340 cm⁻¹** I. P. 398.5 volts

Ferner has extended the preliminary analysis by Söderqvist and has classified 30 lines in the region between 44 A and 63 A. He has kindly furnished his manuscript in advance of publication.

No intersystem combinations have been observed, as indicated by x in the table, but absolute values of the singlet and triplet terms are known from the series.

Ferner's unit, 10^3 cm⁻¹, has here been changed to cm⁻¹.

REFERENCES

J. Söderqvist, Nova Acta Reg. Soc. Sci Uppsala [IV] **9**, No. 7, 94 (1934). (T) (C L)

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 27 (1948). (I P) (T) (C L)

Al x

Author	Config.	Desig.	J	Level	Interval
2s ¹S₀	2s²	2s² ¹S	0	0	
2p ³P₀ ³P₁ ³P₂	2s(²S)2p	2p ³P°	0 1 2	154850+x 156540+x 160200+x	1690 3660
2p ¹P₁	2s(²S)2p	2p ¹P°	1	300400	
2p' ³P	2p²	2p² ³P	0 1 2	404300+x 406270+x 409460+x	1970 3190
2p' ¹D₂	2p²	2p² ¹D	2	448840	
2p' ¹S₀	2p²	2p² ¹S	0	553270	
3s ³S₁	2s(²S)3s	3s ³S	1	1855510+x	
3s ¹S₀	2s(²S)3s	3s ¹S	0	1884330	
3p ¹P₁	2s(²S)3p	3p ¹P°	1	1923850	
3d ³D₁ ³D₂ ³D₃	2s(²S)3d	3d ³D	1 2 3	1965560+x 1965770+x 1966050+x	210 280
3d ¹D₂	2s(²S)3d	3d ¹D	2	1992250	
	2p(²P°)3s	3s ³P°	0 1 2	2056910+x	
3s' ³P₂					
3s' ¹P₁	2p(²P°)3s	3s ¹P°	1	2090980	

Author	Config.	Desig.	J	Level	Interval
3p' ¹P₁	2p(²P°)3p	3p ¹P	1	2094730	
3p' ³D₁ ³D₂ ³D₃	2p(²P°)3p	3p ³D	1 2 3	2101950+x 2103560+x 2107290+x	1610 3730
3p' ³S₁	2p(²P°)3p	3p ³S	1	2119440+x	
3p' ³P₁ ³P₂	2p(²P°)3p	3p ³P	0 1 2	2128300+x 2130180+x	1880
3d' ¹D₂	2p(²P°)3d	3d ¹D°	2	2140690	
3p' ¹D₂	2p(²P°)3p	3p ¹D	2	2148320	
3d' ³D₂ ³D₃	2p(²P°)3d	3d ³D°	1 2 3	2161630+x 2163110+x	1480
3d' ³P₂ ³P₁	2p(²P°)3d	3d ³P°	2 1 0	2169960+x 2171350+x	−1390
3d' ¹F₃	2p(²P°)3d	3d ¹F°	3	2192060	
4d ¹D₂	2s(²S)4d	4d ¹D	2	2527470	
4d' ¹F₃	2p(²P°)4d	4d ¹F°	3	2714560	
Al xi (²S½)		Limit		3215340	

August 1947.

Al x Observed Terms*

Config. 1s²+	Observed Terms		
2s²	2s² ¹S		
2s(²S)2p	{ 2p ³P° 2p ¹P°		
2p²	{ 2p² ¹S 2p² ³P 2p² ¹D		
	ns (n ≥ 3)	np (n ≥ 3)	nd (n ≥ 3)
2s(²S)nx	{ 3s ³S 3s ¹S	3p ¹P°	3d ³D 3, 4d ¹D
2p(²P°)nx	{ 3s ³P° 3s ¹P°	3p ³S 3p ³P 3p ³D 3p ¹P 3p ¹D	3d ³P° 3d ³D° 3d ¹D° 3, 4d ¹F°

*For predicted terms in the spectra of the Be ı isoelectronic sequence, see Introduction.

Al XI

(Li I sequence; 3 electrons) $Z=13$

Ground state $1s^2\, 2s\ ^2S_{1/2}$

$2s\ ^2S_{1/2}$ **3564900 cm^{-1}**   I. P. 441.9 volts

The analysis is by Ferner, who kindly furnished his manuscript in advance of publication. Seven lines have been classified between 39 A and 54 A. Observations of the resonance lines have not been reported. Some of the relative levels have been connected by a study of the behavior of the Rydberg denominators rather than by the Ritz combination principle.

Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 25 (1948).   (I P) (T) (C L)

Al XI

Config.	Desig.	J	Level	Interval
$2s$	$2s$ ^2S	$\frac{1}{2}$	0	
$2p$	$2p$ $^2P°$	$\frac{1}{2}$	*175900*	5920
		$1\frac{1}{2}$	*181820*	
$3s$	$3s$ ^2S	$\frac{1}{2}$	2020460	
$3p$	$3p$ $^2P°$	$\frac{1}{2}$	*2068770*	1750
		$1\frac{1}{2}$	*2070520*	
$3d$	$3d$ ^2D	$1\frac{1}{2}$	2087980	560
		$2\frac{1}{2}$	2088540	
$4d$	$4d$ ^2D	$1\frac{1}{2}$		
		$2\frac{1}{2}$	2734140	
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Al XII ($^1S_0$)	*Limit*	---	**3564900**	

August 1947.

Al XII

(He I sequence; 2 electrons) $Z=13$

Ground state $1s^2$ $^1S_0$

$1s^2$ $^1S_0$ **16825000±3000 cm⁻¹**   I. P. 2085.46±0.37 volts

   Flemberg has observed the first three members of the singlet series; the lines are in the region between 6 A and 7 A.   He has calculated absolute term values on the assumption that the P-terms can be represented by a Ritz formula.
   The unit adopted by Flemberg, 10^3 cm⁻¹, has here been changed to cm⁻¹.

REFERENCE

H. Flemberg, Ark. Mat. Astr. Fys. (Stockholm) **28A,** No. 18 p. 34 (1942).   (I P) (T) (C L)

Al XII

Config.	Desig.	J	Level
$1s^2$	$1s^2$ ^1S	0	0
$1s$ $2p$	$2p$ $^1P°$	1	*12891900*
$1s$ $3p$	$3p$ $^1P°$	1	*15072700*
$1s$ $4p$	$4p$ $^1P°$	1	*15838600*
- - - - - - -	- - - - - -	- - -	- - - - - - - -
Al XIII ($^2S_{½}$)	*Limit*	- - -	**16825000**

October 1946.

SILICON

Si I

14 electrons $Z=14$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^2\,{}^3P_0$

$3p^2\,{}^3P_0$ **65743.00** cm^{-1} I. P. 8.149 volts

The terms are from Kiess, who has revised and extended the earlier work on analysis. He has published a complete list of classified lines extending from 1565 A to 12270 A. His notation has been adopted throughout, except for the following entries, which have been changed for uniformity:

Kiess	Desig.	Kiess	Desig.
$3p\,{}^3P$	$3p^2\,{}^3P$	$3p'\,{}^3D°$	$3p^3\,{}^3D°$
$3p\,{}^1D$	$3p^2\,{}^1D$	x'	$1°$
$3p\,{}^1S$	$3p^2\,{}^1S$	x''	$2°$

The singlet and triplet terms are connected by numerous intersystem combinations. No quintet terms have been found.

The Si I sequence invites further study from the theoretical point of view. In Si I the $3d\,{}^3D°$ term is lower than the $3p^3\,{}^3D°$ term. In later members of the sequence the corresponding terms appear in the reverse order.

The extension by Kiess of the laboratory analysis to cover the infrared region has been of special astrophysical importance. The leading lines of Si I are strong in the solar spectrum. Conversely, the solar wave-number separations within the multiplets afford a valuable check on the accuracy of infrared solar wavelengths, provided the Si lines are unblended in the sun. The satisfactory internal agreement within the "solar" Si multiplets has also justified the use of this method to identify solar lines by prediction as unquestionably due to Si, although they have not yet been observed in the laboratory.

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Config.	Desig.	J	Level	Interval
$3s^2\,3p^2$	$3p^2\ ^3P$	0	0.00	77.15
		1	77.15	146.16
		2	223.31	
$3s^2\,3p^2$	$3p^2\ ^1D$	2	6298.81	
$3s^2\,3p^2$	$3p^2\ ^1S$	0	15394.24	
$3s^2\,3p(^2P^\circ)4s$	$4s\ ^3P^\circ$	0	39683.10	77.10
		1	39760.20	194.92
		2	39955.12	
$3s^2\,3p(^2P^\circ)4s$	$4s\ ^1P^\circ$	1	40991.74	
$3s^2\,3p(^2P^\circ)3d$	$3d\ ^3D^\circ$	1	45276.20	17.40
		2	45293.60	28.26
		3	45321.86	
$3s^2\,3p(^2P^\circ)4p$	$4p\ ^1P$	1	47284.20	
$3s^2\,3p(^2P^\circ)3d$	$3d\ ^1D^\circ$	2	47351.50	
$3s^2\,3p(^2P^\circ)4p$	$4p\ ^3D$	1	48020.00	82.38
		2	48102.38	161.97
		3	48264.35	
$3s\,3p^3$	$3p^3\ ^3D^\circ$	1	48399.15	178.45
		2	48577.60	296.36
		3	48873.96	
$3s^2\,3p(^2P^\circ)4p$	$4p\ ^3P$	0	49028.17	32.38
		1	49060.55	128.06
		2	49188.61	
$3s^2\,3p(^2P^\circ)4p$	$4p\ ^3S$	1	49399.66	
$3s^2\,3p(^2P^\circ)3d$	$3d\ ^3F^\circ$	2	49850.93	83.19
		3	49934.12	137.76
		4	50071.88	
$3s^2\,3p(^2P^\circ)4p$	$4p\ ^1D$	2	50189.43	
$3s^2\,3p(^2P^\circ)3d$	$3d\ ^3P^\circ$	2	50499.44	−66.51
		1	50565.95	−36.20
		0	50602.15	
$3s^2\,3p(^2P^\circ)4p$	$4p\ ^1S$	0	51611.77	
$3s^2\,3p(^2P^\circ)3d$	$3d\ ^1F^\circ$	3	53362.41	
$3s^2\,3p(^2P^\circ)3d$	$3d\ ^1P^\circ$	1	53387.17	
$3s^2\,3p(^2P^\circ)4d$	$4d\ ^3D^\circ$	1	54184.97	20.15
		2	54205.12	52.28
		3	54257.40	
$3s^2\,3p(^2P^\circ)5s$	$5s\ ^3P^\circ$	0	54244.58	69.32
		1	54313.90	213.98
		2	54527.88	
$3s^2\,3p(^2P^\circ)5s$	$5s\ ^1P^\circ$	1	54870.99	
$3s^2\,3p(^2P^\circ)5p$	$5p\ ^1P$	1	56425.1	
$3s^2\,3p(^2P^\circ)4d$	$4d\ ^1D^\circ$	2	56503.00	
$3s^2\,3p(^2P^\circ)4d$	$4d\ ^3P^\circ$	2	56690.94	−9.90
		1	56700.84	−32.40
		0	56733.24	

Config.	Desig.	J	Level	Interval
$3s^2\,3p(^2P^\circ)5p$	$5p\ ^3D$	1	56978.00	39.26
		2	57017.26	180.68
		3	57197.94	
$3s^2\,3p(^2P^\circ)5p$	$5p\ ^3P$	0	57295.76	32.88
		1	57328.64	139.54
		2	57468.18	
$3s^2\,3p(^2P^\circ)4d$	$4d\ ^3F^\circ$	2	57372.44	78.26
		3	57450.70	133.15
		4	57583.85	
$3s^2\,3p(^2P^\circ)5p$	$5p\ ^3S$	1	57541.86	
$3s^2\,3p(^2P^\circ)5p$	$5p\ ^1D$	2	57797.82	
$3s^2\,3p(^2P^\circ)5p$	$5p\ ^1S$	0	58311.19	
$3s^2\,3p(^2P^\circ)4f$	$4f\ ^1F$	3	58774.18	
$3s^2\,3p(^2P^\circ)4f$	$4f\ ^3F$	2	58775.44	11.36
		3	58786.80	2.20
		4	58789.00	
$3s^2\,3p(^2P^\circ)4d$	$4d\ ^1P^\circ$	1	58802.00	
$3s^2\,3p(^2P^\circ)4d$	$4d\ ^1F^\circ$	3	58893.28	
$3s^2\,3p(^2P^\circ)4f$	$4f\ ^3G$	3	59035.15	1.85
		4	59037.00	16.84
		5	59053.84	
$3s^2\,3p(^2P^\circ)5d$	$5d\ ^3D^\circ$	1	59056.70	−24.28
		2	59032.42	86.09
		3	59118.51	
$3s^2\,3p(^2P^\circ)4f$	$4f\ ^3D$	3	59109.75	−81.09
		2	59190.84	0.44
		1	59190.40	
	1°	?	59109.9	
$3s^2\,3p(^2P^\circ)4f$	$4f\ ^1D$	2	59110.91	
	2°	?	59132.5	
$3s^2\,3p(^2P^\circ)6s$	$6s\ ^3P^\circ$	0	59220.76	52.52
		1	59273.28	232.89
		2	59506.17	
$3s^2\,3p(^2P^\circ)6s$	$6s\ ^1P^\circ$	1	59636.34	
$3s^2\,3p(^2P^\circ)5d$	$5d\ ^3P^\circ$	2	59917.35	−92.75
		1	60010.10	−32.38
		0	60042.48	
$3s^2\,3p(^2P^\circ)5d$	$5d\ ^1D^\circ$	2	60299.92	
$3s^2\,3p(^2P^\circ)5d$	$5d\ ^3F^\circ$	2	60645.49	60.41
		3	60705.90	143.23
		4	60849.13	
$3s^2\,3p(^2P^\circ)5f$	$5f\ ^1D$	2	61303.28	
$3s^2\,3p(^2P^\circ)5f$	$5f\ ^3F$	2	61304.50	0.36
		3	61304.86	1.71
		4	61306.57	

Config.	Desig.	J	Level	Interval
3s² 3p(²P°)5d	5d ¹P°	1	61308.82	
3s² 3p(²P°)6d	6d ³D°	1	61510.71	−86.78
		2	61423.93	151.87
		3	61575.80	
3s² 3p(²P°)5d	5d ¹F°	3	61424.00	
3s² 3p(²P°)7s	7s ³P°	0	61540.00	54.80
		1	61594.80	228.64
		2	61823.44	
3s² 3p(²P°)5f	5f ³G	3	61562.37	1.38
		4	61563.75	
		5		
3s² 3p(²P°)5f	5f ³D	3	61597.12	−0.78
		2	61597.90	−0.70
		1	61598.60	
3s² 3p(²P°)6d	6d ³P°	2	61845.96	−90.90
		1	61936.86	−33.42
		0	61970.28	
3s² 3p(²P°)7s	7s ¹P°	1	61881.50	
3s² 3p(²P°)6d	6d ¹D°	2	62155.20	
3s² 3p(²P°)6d	6d ³F°	2	62349.27	27.41
		3	62376.68	157.78
		4	62534.46	

October 1947.

Config.	Desig.	J	Level	Interval
3s² 3p(²P°)6f	6f ³F	2	62668.50	
		3		
		4		
3s² 3p(²P°)8s	8s ³P°	0	62753.05	55.90
		1	62808.95	114.80
		2	62923.75	
3s² 3p(²P°)6d	6d ¹F°	3	62802.00	
3s² 3p(²P°)7d	7d ³D°	1	62873.90	1.28
		2	62875.18	61.12
		3	62936.30	
3s² 3p(²P°)8s	8s ¹P°	1	63130.60	
3s² 3p(²P°)7d	7d ³F°	2	63257.61	96.09
		3	63353.70	26.93
		4	63580.63	
3s² 3p(²P°)7d	7d ¹F°	3	63642.55	
3s² 3p(²P°)8d	8d ³D°	1		
		2		
		3	63758.35	
3s² 3p(²P°)9s	9s ¹P°	1	63884.95	
Si II (²P°½)	Limit	-----	65743.00	

Si I Observed Terms*

Config. 1s² 2s² 2p⁶+	Observed Terms		
3s² 3p²	{ 3p² ¹S 3p² ³P 3p² ¹D		
3s 3p³	3p³ ³D°		

Config. 1s² 2s² 2p⁶+	ns (n≥4)	np (n≥4)	
3s² 3p(²P°)nx	{ 4–8s ³P° 4–9s ¹P°	4, 5p ³S 4, 5p ³P 4, 5p ³D	4, 5p ¹S 4, 5p ¹P 4, 5p ¹D

Config. 1s² 2s² 2p⁶+	nd (n≥3)	nf (n≥4)	
3s² 3p(²P°)nx	{3–6d ³P° 3–8d ³D° 3–7d ³F° 3–5d ¹P° 3–6d ¹D° 3–7d ¹F°	4, 5f ³D 4–6f ³F 4, 5g ³G	4, 5f ¹D 4f ¹F

*For predicted terms in the spectra of the Si I isoelectronic sequence, see Introduction.

Si II

(Al I sequence; 13 electrons) $Z=14$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\;{}^2\mathrm{P}^{\circ}_{\frac{1}{2}}$

$3p\;{}^2\mathrm{P}^{\circ}_{\frac{1}{2}}$ **131818** cm^{-1} I. P. 16.34 volts

The doublet terms from the ^{1}S limit in Si III are from Fowler. His values of $nf\;{}^2\mathrm{F}^{\circ}$, $n=7$ to 9, are from his series formula and are indicated by brackets in the table, although they appear to be confirmed by observed combinations with $3p^2\;{}^2\mathrm{D}$.

The $3p^2\;{}^2\mathrm{P}$ term has been calculated from the data given by Bowen and Millikan in 1925.

The remaining terms are from Bowen, who pointed out in his 1928 paper that Fowler's term called "x" is $3p^2\;{}^2\mathrm{D}$; and listed the two lines classified as $3p\;{}^2\mathrm{P}^{\circ}-3p^2\;{}^2\mathrm{S}$. This combination has been used to calculate $3p^2\;{}^2\mathrm{S}$.

The quartet terms are from Bowen's 1932 paper. No intersystem combinations have been observed and the uncertainty, x, may be considerable. Bowen remarks that the relative positions of the doublet and quartet terms are only approximately determined by assuming that the difference between the terms $4s\;{}^2\mathrm{S}$ and $4s\;{}^4\mathrm{P}^{\circ}$ is equal to that between the terms $3s^2\;{}^1\mathrm{S}$ and $3p\;{}^3\mathrm{P}^{\circ}$ in Si III.

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Si II

Config.	Desig.	J	Level	Interval
$3s^2(^1\mathrm{S})3p$	$3p$ $^2\mathrm{P}^{\circ}$	½ 1½	0 287	287
$3s\,3p^2$	$3p^2$ $^4\mathrm{P}$	½ 1½ 2½	44080. 3+x 44190. 9+x 44364. 4+x	110. 6 173. 5
$3s\,3p^2$	$3p^2$ $^2\mathrm{D}$	1½ 2½	55303. 93 55319. 84	15. 91
$3s^2(^1\mathrm{S})4s$	$4s$ $^2\mathrm{S}$	½	65495. 08	
$3s\,3p^2$	$3p^2$ $^2\mathrm{S}$	½	76663. 9	
$3s^2(^1\mathrm{S})3d$	$3d$ $^2\mathrm{D}$	1½ 2½	79334. 89 79351. 49	16. 60
$3s^2(^1\mathrm{S})4p$	$4p$ $^2\mathrm{P}^{\circ}$	½ 1½	81185. 98 81245. 98	60. 00
$3s\,3p^2$	$3p^2$ $^2\mathrm{P}$	½ 1½	83800 84004	204
$3s^2(^1\mathrm{S})5s$	$5s$ $^2\mathrm{S}$	½	97966. 60	
$3s^2(^1\mathrm{S})4d$	$4d$ $^2\mathrm{D}$	1½ 2½	101017. 58 101018. 88	1. 30
$3s^2(^1\mathrm{S})4f$	$4f$ $^2\mathrm{F}^{\circ}$	{ 2½ 3½ }	103552. 58	
$3s^2(^1\mathrm{S})5p$	$5p$ $^2\mathrm{P}^{\circ}$	½ 1½	103855. 29 103879. 60	24. 31
$3s^2(^1\mathrm{S})6s$	$6s$ $^2\mathrm{S}$	½	111178. 95	
$3s^2(^1\mathrm{S})5d$	$5d$ $^2\mathrm{D}$	{ 1½ 2½ }	112389. 2	

Config.	Desig.	J	Level	Interval
$3s^2(^1\mathrm{S})5f$	$5f$ $^2\mathrm{F}^{\circ}$	{ 2½ 3½ }	113756. 60	
$3s^2(^1\mathrm{S})6p$	$6p$ $^2\mathrm{P}^{\circ}$	½ 1½	114048. 7 114057. 8	9. 1
$3s^2(^1\mathrm{S})7s$	$7s$ $^2\mathrm{S}$	½	117908. 93	
$3s\,3p(^3\mathrm{P}^{\circ})4s$	$4s$ $^4\mathrm{P}^{\circ}$	½ 1½ 2½	118118. 0+x 118234. 0+x 118433. 9+x	116. 0 199. 9
$3s^2(^1\mathrm{S})6d$	$6d$ $^2\mathrm{D}$	{ 1½ 2½ }	118516. 6	
$3s^2(^1\mathrm{S})6f$	$6f$ $^2\mathrm{F}^{\circ}$	{ 2½ 3½ }	119307. 57	
$3s^2(^1\mathrm{S})7f$	$7f$ $^2\mathrm{F}^{\circ}$	{ 2½ 3½ }	[122649]	
$3p^3$	$3p^3$ $^4\mathrm{S}^{\circ}$	1½	124291. 2+x	
$3s^2(^1\mathrm{S})8f$	$8f$ $^2\mathrm{F}^{\circ}$	{ 2½ 3½ }	[124814]	
$3s^2(^1\mathrm{S})9f$	$9f$ $^2\mathrm{F}^{\circ}$	{ 2½ 3½ }	[126294]	
Si III ($^1\mathrm{S}_0$)	Limit	‒‒‒‒‒‒‒‒	131818	
$3s\,3p(^3\mathrm{P}^{\circ})4p$	$4p$ $^4\mathrm{P}$	½ 1½ 2½	135272. 4+x 135334. 6+x 135469. 4+x	62. 2 134. 8
$3s\,3p(^3\mathrm{P}^{\circ})4p$	$4p$ $^4\mathrm{S}$	1½	136161. 1+x	

September 1947.

<p align="center">Si II Observed Terms*</p>

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms			
$3s^2(^1S)3p$	$3p$ $^2P^\circ$			
$3s\,3p^2$	$\{$ $3p^2$ ^2S $\quad$ $3p^2$ ^4P $3p^2$ ^2P $\quad$ $3p^2$ ^2D			
$3p^3$	$3p^3$ $^4S^\circ$			
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$	$nf\ (n\geq 4)$
$3s^2(^1S)nx$	$4-7s$ ^2S	$4-6p$ $^2P^\circ$	$3-6d$ ^2D	$4-6f$ $^2F^\circ$
$3s\,3p(^3P^\circ)nx$	$4s$ $^4P^\circ$	$4p$ ^4S $\quad$ $4p$ ^4P		

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

<p align="center">Si III</p>

<p align="center">SEE REVISION IN NSRDS-NBS 3, Section 1, June 1965.</p>

(Mg I sequence; 12 electrons) $\hspace{4cm}$ $Z=14$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,{}^1S_0$

$3s^2\ {}^1S_0$ **269940.6 cm^{-1}** $\hspace{4cm}$ I. P. 33.46 volts

The analysis is from Bowen, who has extended the earlier work of Fowler, by observations in the ultraviolet. Ninety-six lines have been classified in the interval 566 A to 5739 A. One intersystem combination, $3s^2\ {}^1S-3p\ {}^3P^\circ_1$, is given, but Bowen states that the identification of this line is dubious. He remarks further that "the term values of the singlets and triplets can be independently determined with an accuracy that precludes any large shift in the relative position of the two systems, regardless of this identification." The irregular doublet law for the isoelectronic sequence through P IV confirms this classification, as has been pointed out by Robinson.

Van Vleck and Whitelaw, by analogy with Al II, using a rigorous series formula, have recalculated the absolute value of $5g\ {}^3G$ as equal to 39831 cm^{-1} as compared with Fowler's value 39741 cm^{-1} and Bowen's value 39734.0 cm^{-1}.

<p align="center">REFERENCES</p>

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Si III   **Si III**

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2$ ¹S	0	0.0		$3s(^2S)4d$	$4d$ ¹D	2	204329.6	
$3s(^2S)3p$	$3p$ ³P°	0	52630	128	$3s(^2S)5s$	$5s$ ³S	1	206079.6	
		1	52758	261	$3s(^2S)5s$	$5s$ ¹S	0	207872.5	
		2	53019						
$3s(^2S)3p$	$3p$ ¹P°	1	82883.0		$3s(^2S)4f$	$4f$ ³F°	2	209436.7	27.6
$3p^2$	$3p^2$ ¹D	2	121946				3	209464.3	39.5
$3s(^2S)3d$	$3d$ ¹D	2	122213.0				4	209503.8	
$3p^2$	$3p^2$ ³P	0	129615	132	$3p(^2P°)3d$	$3d$ ³P°	2	216095	−98
		1	129747	259			1	216193	−62
		2	130006				0	216255	
$3s(^2S)3d$	$3d$ ³D	3	142847.6	−2.1	$3p(^2P°)3d$	$3d$ ³D°	1	217290	54
		2	142849.7	−2.0			2	217344	51
		1	142851.7				3	217395	
$3s(^2S)4s$	$4s$ ³S	1	153281.0		$3p(^2P°)4s$	$4s$ ³P°	0	226305	127
$3p^2$	$3p^2$ ¹S	0	153443.0				1	226432	295
							2	226727	
$3s(^2S)4s$	$4s$ ¹S	0	159068.4		$3s(^2S)5g$	$5g$ ³G	3, 4, 5	230206.6	
$3s(^2S)4p$	$4p$ ³P°	0	175134.0	33.0	$3s(^2S)6g$	$6g$ ³G	3, 4, 5	242379.0	
		1	175167.0	73.2	$3p(^2P°)4p$	$4p$ ³P	0	247776	83
		2	175240.2				1	247859	214
$3s(^2S)4p$	$4p$ ¹P°	1	176485.9				2	248073	
$3s(^2S)4d$	$4d$ ³D	3, 2, 1	201502.5		Si IV ($^2S_{½}$)	Limit	---------	269940.6	

July 1947.

Si III Observed Terms*

Config. $1s^2\,2s^2\,2p^6$	Observed Terms				
$3s^2$	$3s^2$ ¹S				
$3s(^2S)3p$	{ $3p$ ³P° $3p$ ¹P°				
$3p^2$	{ $3p^2$ ¹S $3p^2$ ³P $3p^2$ ¹D				
	ns ($n \geq 4$)	np ($n \geq 4$)	nd ($n \geq 3$)	nf ($n \geq 4$)	ng ($n \geq 5$)
$3s(^2S)nx$	{ 4, 5s ³S 4, 5s ¹S	$4p$ ³P° $4p$ ¹P°	3, 4d ³D 3, 4d ¹D	$4f$ ³F°	5, 6g ³G
$3p(^2P°)np$	$4s$ ³P°	$4p$ ³P	$3d$ ³P° $3d$ ³D°		

*For predicted terms in the spectra of the Mg I isoelectronic sequence, see Introduction.

Si IV

(Na I sequence; 11 electrons) $Z=14$

Ground state $1s^2\, 2s^2\, 2p^6\, 3s\, {}^2S_{1/2}$

$3s\ {}^2S_{1/2}$ 364097.7 cm^{-1} I. P. 45.13 volts

       The first detailed analysis by Fowler was extended and improved by Edlén and Söderqvist, who observed the spectrum from 815 A to 4328 A. The terms have been taken from their paper, extrapolated values being entered in brackets. They estimate the accuracy of the limit as probably within 2 or 3 cm^{-1}. One additional term, $8f\ {}^2F°$, has been taken from Fowler's paper and corrected slightly to agree with the rest.

       The observations by McLennan and Shaver extend to the violet limit 458 A and those by Millikan and Bowen extend to 361 A.

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Si IV

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
3s	3s ²S	½	0. 0		6d	6d ²D	1½ 2½	313923. 4	
3p	3p ²P°	½ 1½	71289. 6 71749. 9	460. 3	6f	6f ²F°	2½ 3½	315231. 6	
3d	3d ²D	1½ 2½	160376. 8		6g	6g ²G	{ 3½ 4½ }	315306. 8	
4s	4s ²S	½	193981. 5		6h	6h ²H°	{ 4½ 5½ }	315320. 0	
4p	4p ²P°	½ 1½	218269. 5 218431. 3	161. 8	7s	7s ²S	½	318744. 5	
4d	4d ²D	1½ 2½	250010. 6		7p	7p ²P°	½ 1½	[322347]	
4f	4f ²F°	2½ 3½	254129. 4 254130. 7	1. 3	7d	7d ²D	1½ 2½	[327369]	
5s	5s ²S	½	265420. 4		7f	7f ²F°	2½ 3½	328201. 5	
5p	5p ²P°	½ 1½	276506. 5 276581. 8	75. 3	7g	7g ²G	{ 3½ 4½ }	328251. 7	
5d	5d ²D	1½ 2½	291499. 2		7h	7h ²H°	{ 4½ 5½ }	328262	
5f	5f ²F°	2½ 3½	293721. 0		8f	8f ²F°	{ 2½ 3½ }	[336619]	
5g	5g ²G	{ 3½ 4½ }	293839. 7						
6s	6s ²S	½	299679. 6		Si V (¹S₀)	Limit	---------	364097. 7	
6p	6p ²P°	½ 1½	305645 305687. 6	43					

Si v

(Ne I sequence; 10 electrons) $Z=14$

Ground state $1s^2\,2s^2\,2p^6\;{}^1S_0$

$2p^6\;{}^1S_0$ **1345100** cm^{-1} I. P. 166.73 volts

The analysis is by Ferner, who has extended the early work by Söderqvist. Thirteen lines have been classified in the region 78 A to 118 A, as combinations with the ground term.

Ferner's term designations assigned on the assumption of *LS*-coupling are given under the heading "Author" in the table.

As for Ne I, the *jl*-coupling notation in the general form suggested by Racah is introduced. The unit used by Ferner, 10^3 cm^{-1}, has here been changed to cm^{-1}.

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E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A,** No. 4 p. 4 (1941).   (I P) (T) (C L).
G. Racah, Phys. Rev. **61,** 537 (L) (1942).

Si v

Author	Config.	Desig.	J	Level	Author	Config.	Desig.	J	Level
$2p\;{}^1S$	$2p^6$	$2p^6\;{}^1S$	0	0	$4d\;{}^1P_1$	$2p^5({}^2P^o_{1\frac12})4d$	$4d\,[1\frac12]^o$	1	*1168550*
	$2p^5({}^2P^o_{1\frac12})3s$	$3s\,[1\frac12]^o$	2		$4d\;{}^3D_1$	$2p^5({}^2P^o_{\frac12})4d$	$4d'[1\frac12]^o$	1	*1174050*
$3s\;{}^3P_1$			1	*840560*					
	$2p^5({}^2P^o_{\frac12})3s$	$3s'[\,\frac12]^o$	0		$5d\;{}^1P_1$	$2p^5({}^2P^o_{1\frac12})5d$	$5d\,[1\frac12]^o$	1	*1232850*
$3s\;{}^1P_1$			1	*848460*	$5d\;{}^3D_1$	$2p^5({}^2P^o_{\frac12})5d$	$5d'[1\frac12]^o$	1	*1237520*
	$2p^5({}^2P^o_{1\frac12})3d$	$3d\,[\,\frac12]^o$	0		$6d\;{}^1P_1$	$2p^5({}^2P^o_{1\frac12})6d$	$6d\,[1\frac12]^o$	1	*1267380*
$3d\;{}^3P_1$			1	*1018240*	$6d\;{}^3D_1$	$2p^5({}^2P^o_{\frac12})6d$	$6d'[1\frac12]^o$	1	*1272090*
$3d\;{}^1P_1$	"	$3d\,[1\frac12]^o$	1	*1029410*					
$3d\;{}^3D_1$	$2p^5({}^2P^o_{\frac12})3d$	$3d'[1\frac12]^o$	1	*1036930*					
	$2p^5({}^2P^o_{1\frac12})4s$	$4s\,[1\frac12]^o$	2		Si vi $({}^2P^o_{1\frac12})$	*Limit*	-------		1345100
$4s\;{}^3P_1$			1	*1100690*	Si vi $({}^2P^o_{\frac12})$	*Limit*	-------		1350200
	$2p^5({}^2P^o_{\frac12})4s$	$4s'[\,\frac12]^o$	0						
$4s\;{}^1P_1$			1	*1105550*					

April 1947.

Si v Observed Levels*

Config. 1s² 2s²+	Observed Terms		
2p⁶	2p⁶ ¹S		
	ns (n ≥ 3)		nd (n ≥ 3)
2p⁵(²P°)nx	{	3, 4s ³P° 3, 4s ¹P°	3d ³P° 3–6d ³D° 3–6d ¹P°

jl-Coupling Notation		
	Observed Pairs	
	ns (n ≥ 3)	nd (n ≥ 3)
2p⁵(²P°₁½)nx	3, 4s [1½]°	3d [½]° 3–6d [1½]°
2p⁵(²P°½)nx′	3, 4s′ [½]°	3–6d′ [1½]°

*For predicted levels in the spectra of the Ne ɪ isoelectronic
sequence, see Introduction.

Si VI

(F ɪ sequence; 9 electrons) $Z=14$

Ground state $1s^2\, 2s^2\, 2p^5\, ^2P^\circ_{1½}$

$2p^5\, ^2P^\circ_{1½}\ \mathbf{\textit{1654800}}$ cm⁻¹   I. P. 205.11 volts

The terms are from Ferner's paper. He has extended the earlier analysis by Söderqvist
to include 63 classified lines in the range between 65 A and 249 A. All but two of the observed
combinations are with the ground term. According to Ferner some of the term assignments
are somewhat uncertain. The unit adopted by Ferner, 10³ cm⁻¹, has here been changed to cm⁻¹.

By analogy with related spectra in the isoelectronic sequence Robinson has suggested
the following changes in Ferner's term assignments:

Ferner	Robinson	Ferner	Robinson
3d ⁴F₂½	3d ⁴P₂½	3d′ ²S½	3d′ ²P₁½
3d ⁴P₂½	3d ²D₂½	3d′ ²P₁½	3d′ ²D₁½
3d ²D₂½	3d ²F₂½	3d′ ²D₂½ ²D₁½	3d′ ²F₂½ 3d′ ²S½
4d ⁴F₂½	4d ²D₂½	3d′ ²F₂½	3d′ ²D₂½
	4d ⁴P₂½*		4d′ ²S½**
4d ²D₂½ ²D₁½	4d ²D₁½ 4d ²P₁½	4d′ ²S½	4d′ ²P₁½
		4d′ ²D₂½ ²D₁½	4d′ ²D 4d′ ²P½***

*1401250.   **1446330.   ***1445500.

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E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A,** No. 4, p. 5 (1941).   (I P) (T) (C L)
H. A. Robinson, unpublished material (March 1948).   (T) (C L)

Si VI

Config.	Desig.	J	Level	Interval
$2s^2\,2p^5$	$2p^5$ $^2P^\circ$	$1\tfrac{1}{2}$ $\tfrac{1}{2}$	*0* *5100*	-5100
$2s\,2p^6$	$2p^6$ ^2S	$\tfrac{1}{2}$	406500	
$2s^2\,2p^4(^3P)3s$	$3s$ ^4P	$2\tfrac{1}{2}$ $1\tfrac{1}{2}$ $\tfrac{1}{2}$	990460 993640	-3180
$2s^2\,2p^4(^3P)3s$	$3s$ ^2P	$1\tfrac{1}{2}$ $\tfrac{1}{2}$	1005440 1009140	-3700
$2s^2\,2p^4(^1D)3s$	$3s'$ ^2D	$2\tfrac{1}{2}$ $1\tfrac{1}{2}$	1041450 1041500	-50
$2s^2\,2p^4(^1S)3s$	$3s''$ ^2S	$\tfrac{1}{2}$	1094460	
$2s^2\,2p^4(^3P)3d$	$3d$ ^4F	$4\tfrac{1}{2}$ $3\tfrac{1}{2}$ $2\tfrac{1}{2}$ $1\tfrac{1}{2}$	1193290 1194330	-1040
$2s^2\,2p^4(^3P)3d$	$3d$ ^4P	$\tfrac{1}{2}$ $1\tfrac{1}{2}$ $2\tfrac{1}{2}$	1194970 1196040 1197230	1070 1190
$2s^2\,2p^4(^3P)3d$	$3d$ ^2P	$\tfrac{1}{2}$ $1\tfrac{1}{2}$	1200720 1204740	4020
$2s^2\,2p^4(^3P)3d$	$3d$ ^2D	$1\tfrac{1}{2}$ $2\tfrac{1}{2}$	1201100 1202960	1860
$2s^2\,2p^4(^1D)3d$	$3d'$ ^2P	$\tfrac{1}{2}$ $1\tfrac{1}{2}$	1239200 1242390	3190
$2s^2\,2p^4(^1D)3d$	$3d'$ ^2S	$\tfrac{1}{2}$	1241060	
$2s^2\,2p^4(^1D)3d$	$3d'$ ^2D	$2\tfrac{1}{2}$ $1\tfrac{1}{2}$	1242220 1243860	-1640
$2s^2\,2p^4(^1D)3d$	$3d'$ ^2F	$3\tfrac{1}{2}$ $2\tfrac{1}{2}$	1243020	
$2s^2\,2p^4(^1S)3d$	$3d''$ ^2D	$2\tfrac{1}{2}$ $1\tfrac{1}{2}$	1291510 1291800	-290
$2s^2\,2p^4(^3P)4s$	$4s$ ^4P	$2\tfrac{1}{2}$ $1\tfrac{1}{2}$ $\tfrac{1}{2}$	1322980	

Si VI

Config.	Desig.	J	Level	Interval
$2s^2\,2p^4(^3P)4s$	$4s$ ^2P	$1\tfrac{1}{2}$ $\tfrac{1}{2}$	1329900	
$2s^2\,2p^4(^1D)4s$	$4s'$ ^2D	$\{2\tfrac{1}{2}\ 1\tfrac{1}{2}\}$	1371820	
$2s\,2p^5(^3P^\circ)3s$	$3s'''$ $^2P^\circ$	$1\tfrac{1}{2}$ $\tfrac{1}{2}$	*1375840* *1378830*	-2990
$2s^2\,2p^4(^3P)4d$	$4d$ ^4F	$4\tfrac{1}{2}$ $3\tfrac{1}{2}$ $2\tfrac{1}{2}$ $1\tfrac{1}{2}$	1399110 1399450	-340
$2s^2\,2p^4(^3P)4d$	$4d$ ^4P	$\tfrac{1}{2}$ $1\tfrac{1}{2}$ $2\tfrac{1}{2}$	1400880 1401740	860
$2s^2\,2p^4(^3P)4d$	$4d$ ^2P	$\tfrac{1}{2}$ $1\tfrac{1}{2}$	1402510 1406330	3820
$2s^2\,2p^4(^3P)4d$	$4d$ ^2D	$1\tfrac{1}{2}$ $2\tfrac{1}{2}$	1403050 1404870	1820
$2s^2\,2p^4(^1D)4d$	$4d'$ ^2S	$\tfrac{1}{2}$	1444340	
$2s^2\,2p^4(^1D)4d$	$4d'$ ^2D	$2\tfrac{1}{2}$ $1\tfrac{1}{2}$	1445000 1445590	-590
$2s^2\,2p^4(^1D)4d$	$4d'$ ^2P	$\tfrac{1}{2}$ $1\tfrac{1}{2}$	1445030	
$2s^2\,2p^4(^1S)4d$	$4d''$ ^2D	$2\tfrac{1}{2}$ $1\tfrac{1}{2}$	1497100	
$2s^2\,2p^4(^3P)5d$	$5d$ ^2D	$1\tfrac{1}{2}$ $2\tfrac{1}{2}$	1497630	
$2s^2\,2p^4(^1D)5d$	$5d'$ ^2S	$\tfrac{1}{2}$	1538370	
$2s^2\,2p(^1D)5d$	$5d'$ ^2P	$\tfrac{1}{2}$ $1\tfrac{1}{2}$	1538580	
Si VII $(^3P_2)$	*Limit*		*1654800*	

March 1948.

Si VI Observed Terms*

Config. $1s^2+$	Observed Terms			
$2s^2\,2p^5$	$2p^5$ $^2P^\circ$			
$2s\,2p^6$	$2p^6$ ^2S			
	$ns\ (n\ge 3)$		**$nd\ (n\ge 3)$**	
$2s^2\,2p^4(^3P)nx$	{ 3,4s ^4P 3,4s ^2P		3,4d ^4P 3,4d ^4F 3,4d ^2P 3–5d ^2D	
$2s^2\,2p^4(^1D)nx'$		3,4s' ^2D	3–5d' ^2S 3–5d' ^2P 3,4d' ^2D 3d' ^2F	
$2s^2\,2p^4(^1S)nx''$	3s'' ^2S		3,4d'' ^2D	
$2s\,2p^5(^3P^\circ)nx'''$	3s''' $^2P^\circ$			

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

Si VII

(O I sequence; 8 electrons) $Z=14$

Ground state $1s^2\,2s^2\,2p^4\,{}^3P_2$

$2p^4\,{}^3P_2$ **1988000** cm^{-1} I. P. 246.41 volts

In 1941 Ferner published an analysis of this spectrum including 71 classified lines—64 in the region between 54 A and 85 A and 7 between 217 A and 278 A. The present term list is, however, based on later work kindly furnished by him in manuscript form.

Two intersystem combinations have been observed, connecting the triplet and singlet terms.

Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

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E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 48 (1948). (I P) (T) (C L)

Si VII

Config.	Desig.		J.	Level	Interval	Config.	Desig.		J.	Level	Interval
$2s^2\,2p^4$	$2p^4$	^3P	2 1 0	0 4030 5570	−4030 −1540	$2s^2\,2p^3(^2D°)3d$	$3d'$	$^3D°$	3 2 1	1428020 1428090	−70
$2s^2\,2p^4$	$2p^4$	^1D	2	47000		$2s^2\,2p^3(^2D°)3d$	$3d'$	$^1P°$	1	1429680	
$2s^2\,2p^4$	$2p^4$	^1S	0	99780		$2s^2\,2p^3(^2D°)3d$	$3d'$	$^3P°$	2 1 0	1435460 1436750 1437090	−1290 −340
$2s\,2p^5$	$2p^5$	$^3P°$	2 1 0	36 170 366780 368760	−3610 −1980	$2s^2\,2p^3(^2D°)3d$	$3d'$	$^1D°$	2	1436760	
$2s^2\,2p^5$	$2p^5$	$^1P°$	1	506080		$2s^2\,2p^3(^2D°)3d$	$3d'$	$^3S°$	1	1441230	
$2s^2\,2p^3(^4S°)3s$	$3s$	$^3S°$	1	1172470		$2s^2\,2p^3(^2D°)3d$	$3d'$	$^1F°$	3	1447870	
$2s^2\,2p^3(^2D°)3s$	$3s'$	$^3D°$	1, 2, 3	1225150		$2s^2\,2p^3(^2P°)3d$	$3d''$	$^3P°$	0 1 2	1460290 1460860 1461860	570 1000
$2s^2\,2p^3(^2D°)3s$	$3s'$	$^1D°$	2	1236320							
$2s^2\,2p^3(^2P°)3s$	$3s''$	$^3P°$	0 1 2	1261610 1262040	430	$2s^2\,2p^3(^2P°)3d$	$3d''$	$^3F°$	4 3 2	1463270 1466490	−3220
$2s^2\,2p^3(^2P°)3s$	$3s''$	$^1P°$	1	1273170		$2s^2\,2p^3(^2P°)3d$	$3d''$	$^1D°$	2	1466910	
$2s^2\,2p^3(^4S°)3d$	$3d$	$^3D°$	1, 2 2, 3	1367360 1367560	200	$2s^2\,2p^3(^2P°)3d$	$3d''$	$^3D°$	3 2 1	1467390 1470050	−2660
$2s^2\,2p^3(^2D°)3d$	$3d'$	$^3F°$	4 3 2	1426050		$2s^2\,2p^3(^2P°)3d$	$3d''$	$^1P°$	1	1470490	
						$2s^2\,2p^3(^2P°)3d$	$3d''$	$^1F°$	3	1474100	

Si VII—Continued

Config.	Desig.	J.	Level	Interval
2s 2p⁴(⁴P)3s	3s‴ ³P	2 1 0	1499430	
2s 2p⁴(²D)3s	3s^IV ³D	3 2 1	1590930	
2s² 2p³(²D°)4s	4s′ ³D°	1, 2, 3	1631160	
2s² 2p³(²D°)4s	4s′ ¹D°	2	1635820	
2s² 2p³(⁴S°)4d	4d ³D°	1 2, 3	1643740	
2s² 2p³(²P°)4s	4s″ ³P°	0 1 2	1669900	
2s² 2p³(²D°)4d	4d′ ³D°	3, 2 1	1707070	
2s² 2p³(²D°)4d	4d′ ¹P°	1	1707550	
2s² 2p³(²D°)4d	4d′ ³P°	2 1 0	1711010	
2s² 2p³(²D°)4d	4d′ ³S°	1	1712680	

Si VII—Continued

Config.	Desig.	J.	Level	Interval
2s² 2p³(²D°)4d	4d′ ¹F°	3	1714610	
2s² 2p³(²P°)4d	4d″ ³P°	0 1 2	1741130	
2s² 2p³(²P°)4d	4d″ ³D°	3 2 1	1744440	
2s² 2p³(²P°)4d	4d″ ¹F°	3	1748200	
2s² 2p³(⁴S°)5d	5d ³D°	1 2, 3	1769040	
2s² 2p³(²D°)5d	5d′ ³D°	3, 2 1	1834120	
2s² 2p³(²D°)5d	5d′ ³P°	2 1 0	1836140	
2s 2p⁴(⁴P)4s	4s‴ ³P	2 1 0	1887680	
Si VIII (⁴S°_{1½})	Limit	----	1988000	

February 1947.

Si VII Observed Terms*

Config. 1s²+	Observed Terms		
2s² 2p⁴	{ 2p⁴ ¹S $\quad$ 2p⁴ ³P $\quad$ 2p⁴ ¹D		
2s 2p⁵	{ $\quad$ 2p⁵ ³P° $\quad$ 2p⁵ ¹P°		
	ns (n ≥ 3)		**nd (n ≥ 3)**
2s² 2p³(⁴S°)nx	3s ³S°		3–5d ³D°
2s² 2p³(²D°)nx′	{ $\quad$ 3, 4s′ ³D° $\quad$ 3, 4s′ ¹D°	3, 4d′ ³S° $\quad$ 3–5d′ ³P° $\quad$ 3–5d′ ³D° $\quad$ 3d′ ³F°	3, 4d′ ¹P° $\quad$ 3d′ ¹D° $\quad$ 3, 4d′ ¹F°
2s² 2p³(²P°)nx″	{ 3, 4s″ ³P° $\quad$ 3s″ ¹P°	3, 4d″ ³P° $\quad$ 3, 4d″ ³D° $\quad$ 3d″ ³F°	3d″ ¹P° $\quad$ 3d″ ¹D° $\quad$ 3, 4d″ ¹F°
2s 2p⁴(⁴P)nx‴	3, 4s‴ ³P		
2s 2p⁴(²D)nx^IV	3s^IV ³D		

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

(N I sequence; 7 electrons)   Z=14

Ground state $1s^2\,2s^2\,2p^3\,{}^4S^\circ_{1\frac{1}{2}}$

$2p^3\,{}^4S^\circ_{1\frac{1}{2}}$ *2451570* cm⁻¹   I. P. 303.87 volts

The terms published by Ferner in 1941 have been corrected as indicated in his 1948 paper. The absolute values of the quartet terms have been decreased by 250 cm⁻¹; those of the doublet terms increased by 250 cm⁻¹ as compared with the values he published in 1941.

Fifty-nine lines have been classified, all but 13 of which are in the region between 49 A and 76 A. No intersystem combinations have been published and the uncertainty, x, may be considerable.

The unit adopted by Ferner, 10³ cm⁻¹, has here been changed to cm⁻¹.

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J. Söderqvist, Nova Acta Reg. Soc. Sci. Uppsala [IV] **9**, No. 7, 64 (1934). (T) (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A**, No. 4, p. 6 (1941). (I P) (T) (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 42 (1948).

Si VIII

Author	Config.	Desig.	J	Level	Interval
2p ⁴S₂	2s² 2p³	2p³ ⁴S°	1½	0	
2p ²D₂ / ²D₃	2s² 2p³	2p³ ²D°	1½ / 2½	67140+x / 67420+x	280
2p ²P₁ / ²P₂	2s² 2p³	2p³ ²P°	½ / 1½	103320+x / 103900+x	580
2p' ⁴P₃ / ⁴P₂ / ⁴P₁	2s 2p⁴	2p⁴ ⁴P	2½ / 1½ / ½	312670 / 316260 / 318160	−3590 / −1900
2p' ²D₃ / ²D₂	2s 2p⁴	2p⁴ ²D	2½ / 1½	428300+x / 428360+x	−60
2p' ²S₁	2s 2p⁴	2p⁴ ²S	½	502360+x	
2p' ²P₂ / ²P₁	2s 2p⁴	2p⁴ ²P	1½ / ½	528420+x / 532790+x	−4370
3s ⁴P₁ / ⁴P₂ / ⁴P₃	2s² 2p²(³P)3s	3s ⁴P	½ / 1½ / 2½	1430510 / 1432870 / 1436120	2360 / 3250
3s ²P₁ / ²P₂	2s 2p²(³P)3s	3s ²P	½ / 1½	1447950+x / 1451900+x	3950
3s̄ ²D₂ / ²D₃	2s² 2p²(¹D)3s	3s' ²D	1½ / 2½	1486120+x / 1486710+x	590
3d ²P₂	2s² 2p²(³P)3d	3d ²P	1½ / ½	1622900+x	
3s' ⁴S₂	2s 2p³(⁵S°)3s	3s''' ⁴S°	1½	1628660	
3d ²F₃ / ²F₄	2s² 2p²(³P)3d	3d ²F	2½ / 3½	1632010+x / 1636490+x	4480
3d ⁴D₃₂	2s² 2p²(³P)3d	3d ⁴D	3½ / 2½ / 1½ / ½	}1633370	
3d ⁴P₃ / ⁴P₂ / ⁴P₁	2s² 2p²(³P)3d	3d ⁴P	2½ / 1½ / ½	1637470 / 1638830 / 1639640	−1360 / −810

Si VIII

Author	Config.	Desig.	J	Level	Interval
3d ²D₂ / ²D₃	2s² 2p²(³P)3d	3d ²D	1½ / 2½	1657290+x / 1658460+x	1170
3d̄ ²F₄ / ²F₃	2s² 2p²(¹D)3d	3d' ²F	3½ / 2½	1682560+x / 1682780+x	−220
3d̄ ²D₂ / ²D₃	2s² 2p²(¹D)3d	3d' ²D	1½ / 2½	1683930+x / 1685560+x	1630
3d̄ ²P₁ / ²P₂	2s² 2p²(¹D)3d	3d' ²P	½ / 1½	1694560+x / 1696140+x	1580
3p' ⁴P	2s 2p³(⁵S°)3p	3p''' ⁴P	½ to 2½	}1698230	
3d̄ ²S₁	2s² 2p²(¹D)3d	3d' ²S	½	1701700+x	
3d' ⁴D	2s 2p³(⁵S°)3d	3d''' ⁴D°	½ to 3½	}1801710	
4s ²P₂	2s² 2p²(³P)4s	4s ²P	½ / 1½	1927190+x	
4d ²F₃ / ²F₄	2s² 2p²(³P)4d	4d ²F	2½ / 3½	1996930+x / 2000980+x	4050
4d ⁴P₃ / ⁴P₂	2s² 2p²(³P)4d	4d ⁴P	2½ / 1½ / ½	1999240 / 2000520	−1280
4d ²D₃	2s² 2p²(³P)4d	4d ²D	1½ / 2½	2006710+x	
4d̄ ²D₃	2s² 2p²(¹D)4d	4d' ²D	1½ / 2½	2046680+x	
Si IX (³P₀)		Limit	------	2451570	

Si VIII Observed Terms*

Config. $1s^2+$	Observed Terms			
$2s^2\ 2p^3$	$\begin{cases}2p^3\ {}^4S° \\ \end{cases}$ $2p^3\ {}^2P°$ $2p^3\ {}^2D°$			
$2s\ 2p^4$	$\begin{cases} \\ 2p^4\ {}^2S \end{cases}$ $2p^4\ {}^4P$ $2p^4\ {}^2P$ $2p^4\ {}^2D$			

	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$	
$2s^2\ 2p^2(^3P)nx$	$\begin{cases}\\ \\ \end{cases}$ $3s\ {}^4P$ $3,4s\ {}^2P$		$3,4d\ {}^4P$ $3d\ {}^4D$ $3d\ {}^2P$ $3,4d\ {}^2D$ $3,4d\ {}^2F$	
$2s^2\ 2p^2(^1D)nx'$	$3s'\ {}^2D$		$3d'\ {}^2S$ $3d'\ {}^2P$ $3,4d'{}^2D$ $3d'\ {}^2F$	
$2s\ 2p^3(^5S°)nx'''$	$3s'''\ {}^4S°$	$3p'''\ {}^4P$	$3d'''\ {}^4D°$	

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

Si IX

(C I sequence; 6 electrons) $Z=14$

Ground state $1s^2\ 2s^2\ 2p^2\ {}^3P_0$

$2p^2\ {}^3P_0$ **2838460** cm^{-1} I. P. 351.83 volts

The terms have been taken from a manuscript by Ferner who generously submitted his revised analysis in advance of publication. A total of 42 lines have been classified, all but two of which are in the region between 44 A and 65 A. No combinations involving the terms $2p^3\ {}^1D°$ and $2p^3\ {}^1P°$ are listed.

The systems of terms of different multiplicity are not connected by intersystem combinations. Their relative positions are estimated by extrapolation along the isoelectronic sequence. The uncertainties, x and y, may be considerable.

Ferner's unit, $10^3\ cm^{-1}$, has here been converted to cm^{-1}.

REFERENCES

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A,** No. 4 p. 6 (1941). (T) (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 37 (1948). (I P) (T) (C L)

Author	Config.	Desig.		J	Level	Interval	Author	Config.	Desig.		J	Level	Interval
$2p$ $^3P_0$ $^3P_1$ $^3P_2$	$2s^2\,2p^2$	$2p^2$	^3P	0 1 2	0 2590 6460	2590 3870	$3d$ $^1F_3$	$2s^2\,2p(^2P°)3d$	$3d$	$^1F°$	3	$1837810+x$	
							$3d$ $^1P_1$	$2s^2\,2p(^2P°)3d$	$3d$	$^1P°$	1	$1838540+x$	
$2p$ $^1D_2$	$2s^2\,2p^2$	$2p^2$	^1D	2	$52960+x$		$3p'$ $^3S_1$	$2s\,2p^2(^4P)3p$	$3p$	$^3S°$	1	1858590	
$2p$ $^1S_0$	$2s^2\,2p^2$	$2p^2$	^1S	0	$107780+x$			$2s\,2p^2(^4P)3p$	$3p$	$^3D°$	1		
$2p'$ $^5S_2$	$2s\,2p^3$	$2p^3$	$^5S°$	2	$150010+y$		$3p'$ $^3D_2$ $^3D_3$				2 3	1896170 1899040	2870
$2p'$ $^3D_3$ $^3D_2$ $^3D_1$	$2s\,2p^3$	$2p^3$	$^3D°$	3 2 1	292210 292360 292440	-150 -80	$\overline{3s'}$ ^3D	$2s\,2p^2(^2D)3s$	$3s'$	^3D	1, 2, 3	1917080	
$2p'$ ^3P	$2s\,2p^3$	$2p^3$	$^3P°$	2, 1, 0	344080		$3d'$ $^5P_3$ $^5P_2$ $^5P_1$	$2s\,2p^2(^4P)3d$	$3d$	^5P	3 2 1	$1971270+y$ $1972500+y$ $1973460+y$	-1230 -960
$2p'$ $^1D_2$	$2s\,2p^3$	$2p^3$	$^1D°$	2	$440410+x$		$3d'$ $^3P_2$	$2s\,2p^2(^4P)3d$	$3d$	^3P	2 1 0	1973940	
$2p'$ $^3S_1$	$2s\,2p^3$	$2p^3$	$^3S°$	1	446980								
$2p'$ $^1P_1$	$2s\,2p^3$	$2p^3$	$^1P°$	1	$492820+x$		$3d'$ $^3F_2$ $^3F_3$ $^3F_4$	$2s\,2p^2(^4P)3d$	$3d$	^3F	2 3 4	1985150 1987160 1989830	2010 2670
$3s$ $^3P_1$ $^3P_2$	$2s^2\,2p(^2P°)3s$	$3s$	$^3P°$	0 1 2	1623380 1628550	5170	$\overline{3p'}$ $^1F_3$	$2s\,2p^2(^2D)3p$	$3p'$	$^1F°$	3	$1999930+x$	
$3s$ $^1P_1$	$2s^2\,2p(^2P°)3s$	$3s$	$^1P°$	1	$1640920+x$		$\overline{3p'}$ $^1D_2$	$2s\,2p^2(^2D)3p$	$3p'$	$^1D°$	2	$2009410+x$	
$3s'$ $^5P_1$ $^5P_2$ $^5P_3$	$2s\,2p^2(^4P)3s$	$3s$	^5P	1 2 3	$1784260+y$ $1786430+y$ $1789650+y$	2170 3220		$2s\,2p^2(^4P)3d$	$3d$	^3D	1 2, 3	2011690	
$3d$ $^3F_2$	$2s^2\,2p(^3P°)3d$	$3d$	$^3F°$	2 3 4	$1789400+x$		$\overline{3d'}$ ^3F	$2s\,2p^2(^2D)3d$	$3d'$	^3F	2, 3, 4	2084940	
							$\overline{3d'}$ ^3D	$2s\,2p^2(^2D)3d$	$3d'$	^3D	1, 2, 3	2093650	
$3d$ $^1D_2$	$2s^2\,2p(^2P°)3d$	$3d$	$^1D°$	2	$1794090+x$		$\overline{\overline{3d'}}$ ^3F	$2s\,2p^2(^2P)3d$	$3d'''$	^3F	2, 3, 4	2190790	
$3d$ $^3D_1$ $^3D_2$ $^3D_3$	$2s^2\,2p(^2P°)3d$	$3d$	$^3D°$	1 2 3	1808160 1809080 1811480	920 2400		$2s^2\,2p(^2P°)4d$	$4d$	$^3D°$	1 2 3	2264270 2266400	2130
$3d$ $^3P_2$ $^3P_1$ $^3P_0$	$2s^2\,2p(^2P°)3d$	$3d$	$^3P°$	2 1 0	1815690 1816940 1817670	-1250 -730	Si x $(^2P°_{1/2})$		**Limit**		------	2838460	

Si IX Observed Terms*

Config. $1s^2+$	Observed Terms							
$2s^2\,2p^2$	$\{2p^2\,^1S$	$2p^2\,^3P$		$2p^2\,^1D$				
$2s\,2p^3$	$\{\begin{array}{l}2p^3\,^5S°\\2p^3\,^3S°\\2p^3\,^1P°\end{array}$	$2p^3\,^3P°$ $2p^3\,^1D°$	$2p^3\,^3D°$					

Config. $1s^2+$	$ns\ (n\geq 3)$		$np\ (n\geq 3)$		$nd\ (n\geq 3)$			
$2s^2\,2p(^2P°)nx$	$\{$	$3s$ $^3P°$ $3s$ $^1P°$			$3d$ $^3P°$ $3d$ $^1P°$	3, $4d$ $^3D°$ $3d$ $^1D°$	$3d$ $^3F°$ $3d$ $^1F°$	
$2s\,2p^2(^4P)nx$	$\{$	$3s$ ^5P	$3p$ $^3S°$ $3p$ $^3D°$		$3d$ ^5P $3d$ ^3P	$3d$ ^3D	$3d$ ^3F	
$2s\,2p^2(^2D)nx'$	$\{$	$3s'$ ^3D	$3p'$ $^1D°$ $3p'$ $^1F°$			$3d'$ ^3D	$3d'$ ^3F	
$2s\,2p^2(^2P)nx'''$							$3d'''$ ^3F	

*For predicted terms in the spectra of the C I isoelectronic sequence, see Introduction.

Si x

(B I sequence; 5 electrons) $Z=14$

Ground state $1s^2\,2s^2\,2p\ ^2\mathrm{P}^{\circ}_{1/2}$

$2p\ ^2\mathrm{P}^{\circ}_{1/2}\ \mathit{3237400}$ cm⁻¹   I. P. 401.3 volts

Ferner has classified 29 lines in the range between 47 A and 57 A. He has kindly furnished his unpublished manuscript extending the analysis he published in 1941.

No intersystem combinations have been observed, as indicated by x in the table, but the absolute values of the doublet and quartet terms are determined from series. Extrapolated values are in brackets in the table.

The quartet terms are not all connected by observed combinations.

Ferner's unit, 10^3 cm⁻¹, has here been changed to cm⁻¹.

REFERENCES

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A,** No. 4, p. 18 (1941).   (T) (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 30 (1948).   (I P) (T) (C L)

Si x

Author	Config.	Desig.	J	Level	Interval
2p ²P₁ / ²P₂	2s²(¹S)2p	2p ²P°	½, 1½	0, 6990	6990
2p′ ⁴P₁ / ⁴P₂ / ⁴P₃	2s 2p²	2p² ⁴P	½, 1½, 2½	162060+x, 164500+x, 168090+x	2440, 3590
2p′ ²D	2s 2p²	2p² ²D	{ 1½, 2½ }	287830	
2p′ ²S₁	2s 2p²	2p² ²S	½	367650	
2p′ ²P₁ / ²P₂	2s 2p²	2p² ²P	½, 1½	389740, 394000	4260
2p″ ⁴S₂	2p³	2p³ ⁴S°	1½	510190+x	
2p″ ²D₃ / ²D₂	2p³	2p³ ²D°	2½, 1½	574360, 574600	−240
2p″ ²P₁ / ²P₂	2p³	2p³ ²P°	½, 1½	[644560], [644940]	380
3d ²D₂ / ²D₃	2s²(¹S)3d	3d ²D	1½, 2½	1979260, 1979730	470
3s′ ⁴P₁ / ⁴P₂ / ⁴P₃	2s 2p(³P°)3s	3s ⁴P°	½, 1½, 2½	1993860+x, 1996180+x, 2000570+x	2320, 4390
3s′ ²P₂	2s 2p(³P°)3s	3s ²P°	½, 1½	2035810	
3p′ ²P₂	2s 2p(³P°)3p	3p ²P	½, 1½	2066600	

Author	Config.	Desig.	J	Level	Interval
3p′ ²D₃	2s 2p(³P°)3p	3p ²D	1½, 2½	2110260	
3d′ ⁴D₁₂ / ⁴D₃ / ⁴D₄	2s 2p(³P°)3d	3d ⁴D°	{ ½, 1½ }, 2½, 3½	2151950+x, 2152370+x, 2154860+x	420, 2490
3d′ ²D₂ / ²D₃	2s 2p(³P°)3d	3d ²D°	1½, 2½	2153680, 2154440	760
3̄s̄′ ²P	2s 2p(¹P°)3s	3s′ ²P°	{ ½, 1½ }	2158290	
3d′ ⁴P₃	2s 2p(³P°)3d	3d ⁴P°	2½, 1½, ½	2161950+x	
3d′ ²F₃ / ²F₄	2s 2p(³P°)3d	3d ²F°	2½, 3½	2188570, 2193140	4570
3d′ ²P₂ / ²P₁	2s 2p(³P°)3d	3d ²P°	1½, ½	2199190, 2201770	−2580
3̄d̄′ ²F	2s 2p(¹P°)3d	3d′ ²F°	{ 2½, 3½ }	2299860	
3̄d̄′ ²D₂ / ²D₃	2s 2p(¹P°)3d	3d′ ²D°	1½, 2½	2310230, 2311360	1130
3d″ ⁴P₃ / ⁴P₂	2p²(³P)3d	3d″ ⁴P	2½, 1½, ½	2445320+x, 2446860+x	−1540
Si xi (¹S₀)		Limit	------	3237400	

August 1947.

Config. $1s^2+$	Observed Terms				
$2s^2(^1S)2p$		$2p$ $^2P°$			
$2s\,2p^2$	$\{2p^2\ ^2S$	$2p^2\ ^4P$ $2p^2\ ^2P$	$2p^2\ ^2D$		
$2p^3$	$\{2p^3\ ^4S°$	$2p^3\ ^2P°$	$2p^3\ ^2D°$		

	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (n\geq 3)$		
$2s^2(^1S)nx$				$3d$ ^2D	
$2s\,2p(^3P°)nx$	$\{$ $3s$ $^4P°$ $3s$ $^2P°$	$3p$ ^2P $\quad$ $3p$ ^2D	$3d\ ^4P°$ $3d\ ^2P°$	$3d$ $^4D°$ $3d$ $^2D°$	$3d$ $^2F°$
$2s\,2p(^1P°)nx'$	$3s'$ $^2P°$			$3d'$ $^2D°$	$3d'$ $^2F°$
$2p^2(^3P)nx''$				$3d''$ ^4P	

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

Si XI

(Be I sequence; 4 electrons) $\hspace{4cm}$ $Z=14$

Ground state $1s^2\,2s^2\ ^1S_0$

$2s^2\ ^1S_0$ **3840470** cm^{-1} $\hspace{4cm}$ I. P. 476.0 volts

Ferner has published a preliminary analysis giving the classifications of 12 lines in the region between 43 A and 49 A. He has recently extended the earlier work and generously furnished his revised term list in advance of publication, to be used in compiling the list below.

No intersystem combinations have been observed, as indicated by x in the table.

The unit adopted by Ferner, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A,** No. 4 p. 20 (1941). (T) (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 27 (1948). (I P) (T)

Si XI   **Si XI**

Author	Config.	Desig.	J	Level	Interval
$2s\ ^1S_0$	$2s^2$	$2s^2\ ^1S$	0	0	
$2p\ ^3P_0$	$2s(^2S)2p$	$2p\ ^3P°$	0	$169140+x$	
$^3P_1$			1	$171560+x$	2420
$^3P_2$			2	$176810+x$	5250
$2p\ ^1P_1$	$2s(^2S)2p$	$2p\ ^1P°$	1	329400	
$2p'\ ^3P_0$	$2p^2$	$2p^2\ ^3P$	0	$443020+x$	
$^3P_1$			1	$445910+x$	2890
$^3P_2$			2	$450470+x$	4560
$2p'\ ^1D_2$	$2p^2$	$2p^2\ ^1D$	2	493400	
$2p'\ ^1S_0$	$2p^2$	$2p^2\ ^1S$	0	607630	
$3s\ ^1S_0$	$2s(^2S)3s$	$3s\ ^1S$	0	2241480	
$3p\ ^1P_1$	$2s(^2S)3p$	$3p\ ^1P°$	1	2285040	
$3d\ ^3D_2$	$2s(^2S)3d$	$3d\ ^3D$	1		
$^3D_2$			2	$2331390+x$	550
$^3D_3$			3	$2331940+x$	

Author	Config.	Desig.	J	Level	Interval
$3d\ ^1D_2$	$2s(^2S)3d$	$3d\ ^1D$	2	2361010	
	$2p(^2P°)3p$	$3p\ ^3D$	1		
			2		
$3p'\ ^3D_3$			3	$2486810+x$	
$3d'\ ^1D_2$	$2p(^2P°)3d$	$3d\ ^1D°$	2	2523240	
$3p'\ ^1D_2$	$2p(^2P°)3p$	$3p\ ^1D$	2	2532140	
	$2p(^2P°)3d$	$3d\ ^3D°$	1		
$3d'\ ^3D_2$			2	$2546810+x$	2160
$^3D_3$			3	$2548970+x$	
$3d'\ ^3P_2$	$2p(^2P°)3d$	$3d\ ^3P°$	2	$2556220+x$	
			1		
			0		
$3d'\ ^1F_3$	$2p(^2P°)3d$	$3d\ ^1F°$	3	2581130	
Si XII $(^2S_{1/2})$	Limit	------		3840470	

August 1947.

Si XI Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2$	$2s^2\ ^1S$		
$2s(^2S)2p$	$\{$ $2p\ ^3P°$ $2p\ ^1P°$		
$2p^2$	$\{$ $2p^2\ ^1S$ $2p^2\ ^3P$ $2p^2\ ^1D$		

Config. $1s^2+$	$ns\ (n\geq 3)$	$np\ (n\geq 3)$	$nd\ (\geq 3)$
$2s(^2S)nx$	$\{\ 3s\ ^1S$	$3p\ ^1P°$	$3d\ ^3D$ $3d\ ^1D$
$2p(^2P°)nx$	$\{$	$3p\ ^3D$ $3p\ ^1D$	$3d\ ^3P°$ $3d\ ^3D°$ $3d\ ^1D°$ $3d\ ^1F°$

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

(Li I sequence; 3 electrons) $Z=14$

Ground state $1s^2\,2s\ {}^2S_{1/2}$

$2s\ {}^2S_{1/2}$ **4221460** cm^{-1} I. P. 523.2 volts

The classifications of three lines in the region 44 A to 45 A were published by Ferner in 1941, but no terms were given. His absolute term values based on later work, and kindly furnished in advance of publication, have been used in compiling the present list. Observations of the resonance lines have not been reported.

Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **28A,** No. 4 p. 21 (1941). (C L)
E. Ferner, Ark Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 25 (1948). (I P) (T)

Si XII

Config.	Desig.	J	Level	Interval
$2s$	$2s\ {}^2S$	½	0	
$2p$	$2p\ {}^2P°$	½ 1½	*191900* *200290*	8390
$3s$	$3s\ {}^2S$	½	2390580	
$3d$	$3d\ {}^2D$	1½ 2½	2463540 2464530	990
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Si XIII ($^1S_0$)	*Limit*	---	**4221460**	

August 1947.

PHOSPHORUS

P I

15 electrons

$Z=15$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^3\;{}^4\mathrm{S}^\circ_{1\frac12}$

$3p^3\;{}^4\mathrm{S}^\circ_{1\frac12}\;\textbf{\textit{88560}}$ cm^{-1}

I. P. 11.0 volts

Eleven terms have been found by Kiess, who extended earlier work on this spectrum by making the important observations in the infrared to 10813 A. Robinson observed the ultraviolet region as far as 1323 A and was able to extend the analysis.

The present list is taken from Robinson's paper, except for the term $4p\;{}^2\mathrm{P}^\circ$, which has been adjusted to fit the observations by Kiess.

Intersystem combinations connecting the doublet and quartet terms have been observed.

There is not complete agreement about the configuration assignments of $3d\;{}^2\mathrm{P}$ and $3p^4\;{}^2\mathrm{P}$, and those entered in the table are tentative.

REFERENCES

C. C. Kiess, Bur. Std. J. Research **8**, 393, RP425 (1932). (I P) (T) (C L)
H. A. Robinson, Phys. Rev. **49**, 297 (1936). (I P) (T) (C L)
W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs)

P I

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^3$	$3p^3\;{}^4\mathrm{S}^\circ$	$1\frac12$	*0. 0*		$3s^2\,3p^2({}^3\mathrm{P})4p$	$4p\;{}^2\mathrm{P}^\circ$	$\frac12$	*67971. 1*	117. 2
							$1\frac12$	*68088. 3*	
$3s^2\,3p^3$	$3p^3\;{}^2\mathrm{D}^\circ$	$1\frac12$	*11361. 7*	14. 8	$3s^2\,3p^2({}^3\mathrm{P})4p$	$4p\;{}^2\mathrm{S}^\circ$	$\frac12$	*68473. 2*	
		$2\frac12$	*11376. 5*						
$3s^2\,3p^3$	$3p^3\;{}^2\mathrm{P}^\circ$	$\frac12$	*18722. 4*	25. 7	$3s^2\,3p^2({}^3\mathrm{P})3d$	$3d\;{}^2\mathrm{F}$	$2\frac12$	*70391. 3*	298. 7
		$1\frac12$	*18748. 1*				$3\frac12$	*70690. 0*	
$3s^2\,3p^2({}^3\mathrm{P})4s$	$4s\;{}^4\mathrm{P}$	$\frac12$	55939. 23	151. 36	$3s^2\,3p^2({}^3\mathrm{P})3d$	$3d\;{}^4\mathrm{D}$	$\frac12$		
		$1\frac12$	56090. 59	249. 09			$1\frac12$	70637. 5	141. 1
		$2\frac12$	56339. 68				$2\frac12$	70778. 6	
							$3\frac12$		
$3s^2\,3p^2({}^3\mathrm{P})4s$	$4s\;{}^2\mathrm{P}$	$\frac12$	57876. 8	297. 6	$3s\;3p^4$	$3p^4\;{}^2\mathrm{D}$	$2\frac12$	71168. 3	$-34. 3$
		$1\frac12$	58174. 4				$1\frac12$	71202. 6	
$3s\;3p^4$	$3p^4\;{}^4\mathrm{P}$	$2\frac12$	59533. 4	$-180. 2$	$3s^2\,3p^2({}^3\mathrm{P})3d$	$3d\;{}^4\mathrm{P}$	$2\frac12$	72386. 6	$-108. 0$
		$1\frac12$	59713. 6	$-105. 0$			$1\frac12$	72494. 6	$-76. 8$
		$\frac12$	59818. 6				$\frac12$	72571. 4	
$3s^2\,3p^2({}^1\mathrm{D})4s$	$4s'\;{}^2\mathrm{D}$	$\{\ \begin{smallmatrix}1\frac12\\2\frac12\end{smallmatrix}\ \}$	65156. 6		$3s^2\,3p^2({}^3\mathrm{P})3d$	$3d\;{}^2\mathrm{P}$	$\frac12$	72741. 9	141. 6
							$1\frac12$	72883. 5	
$3s^2\,3p^2({}^3\mathrm{P})4p$	$4p\;{}^4\mathrm{D}^\circ$	$\frac12$	*65373. 6*	76. 6	$3s\;3p^4$	$3p^4\;{}^2\mathrm{S}$	$\frac12$	72943. 3	
		$1\frac12$	*65450. 2*	134. 9					
		$2\frac12$	*65585. 1*	202. 2	$3s^2\,3p^2({}^3\mathrm{P})3d$	$3d\;{}^2\mathrm{D}?$	$1\frac12$		
		$3\frac12$	*65787. 3*				$2\frac12$	73248. 1	
$3s^2\,3p^2({}^3\mathrm{P})4p$	$4p\;{}^4\mathrm{P}^\circ$	$\frac12$	*66343. 4*	16. 8	$3s^2\,3p^2({}^3\mathrm{P})5s$	$5s\;{}^4\mathrm{P}$	$\frac12$	75064. 6?	146. 7
		$1\frac12$	*66360. 2*	183. 9			$1\frac12$	75211. 3?	322. 1
		$2\frac12$	*66544. 1*				$2\frac12$	75533. 4?	
$3s^2\,3p^2({}^3\mathrm{P})4p$	$4p\;{}^2\mathrm{D}^\circ$	$1\frac12$	*66813. 1*	57. 1					
		$2\frac12$	*66870. 2?*						
$3s^2\,3p^2({}^3\mathrm{P})4p$	$4p\;{}^4\mathrm{S}^\circ$	$1\frac12$	*66834. 5*		P II (${}^3\mathrm{P}_0$)	*Limit*	--------	*88560*	
$3s\;3p^4$	$3p^4\;{}^2\mathrm{P}$	$1\frac12$	67908. 6	$-217. 6$					
		$\frac12$	68126. 2						

November 1947.

P I Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2\;3p^3$	$\{3p^3\;{}^4S°$	$3p^3\;{}^2P°$	$3p^3\;{}^2D°$
$3s\;\;3p^4$	$\{3p^4\;{}^2S$	$3p^4\;{}^4P$ $3p^4\;{}^2P$	$3p^4\;{}^2D$

	$ns\;(n\geq 4)$	$np\;(n\geq 4)$	$nd\;(n\geq 3)$
$3s^2\;3p^2({}^3P)nx$	$\{$ 4, 5s ${}^4P$ 4s ${}^2P$	$4p\;{}^4S°$ $4p\;{}^4P°$ $4p\;{}^4D°$ $4p\;{}^2S°$ $4p\;{}^2P°$ $4p\;{}^2D°$	$3d\;{}^4P$ $3d\;{}^4D$ $3d\;{}^2P$ $3d\;{}^2D?$ $3d\;{}^2F$
$3s^2\;3p^2({}^1D)nx'$	$4s'\;{}^2D$		

*For predicted terms in the spectra of the P I isoelectronic sequence, see Introduction.

P II

(Si I sequence; 14 electrons) $Z=15$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^2\;{}^3P_0$

$3p^2\;{}^3P_0$ 158550.0 cm^{-1} I. P. 19.65 volts

    The terms are mostly from the 1936 paper by Robinson, who has revised and extended the earlier analysis by Bowen. The singlet and triplet terms are well connected by inter-system combinations.

    In his later paper Robinson adds two quintet terms, and makes a few corrections to his earlier list which have been incorporated here. The quintet terms are not connected by observation with the rest, as indicated by the uncertainty x and brackets denoting that the relative position of $3p^3\;{}^5S°$ is estimated.

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<div align="center">P II   P II</div>

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^2$	$3p^2\ ^3P$	0	0. 0	166. 6	$3s^2\,3p(^2P°)4d$	$4d\ ^3D°$	3	*127333. 6*	−556. 6
		1	166. 6	303. 7			2	*127890. 2*	−45. 5
		2	470. 3				1	*127935. 7*	
$3s^2\,3p^2$	$3p^2\ ^1D$	2	8882. 6		$3s^2\,3p(^2P°)4d$	$4d\ ^3P°$	0	*127368. 7*	232. 5
							1	*127601. 2*	349. 9
$3s^2\,3p^2$	$3p^2\ ^1S$	0	21576. 4				2	*127951. 1*	
$3s\ 3p^3$	$3p^3\ ^5S°$	2	$[52450.\,0]+x$		$3s^2\,3p(^2P°)4d$	$4d\ ^1D°$	2	*129612. 0*	
$3s\ 3p^3$	$3p^3\ ^3D°$	1	*65251. 8*	21. 1	$3s^2\,3p(^2P°)5p$	1 (5p ^{3}S?)	1	129625. 5?	
		2	*65272. 9*	34. 8		2	2	130239. 6	
		3	*65307. 7*			3	1, 2	130826. 2	
$3s\ 3p^3$	$3p^3\ ^3P°$	2	*76764. 9*	−48. 3	$3s^2\,3p(^2P°)5p$	4 (5p ^{1}D?)	2	130913. 9	
		1	*76813. 2*	−11. 2		5	2	130949. 6	
		0	*76824. 4*		$3s^2\,3p(^2P°)5p$	6 (5p ^{1}P?)	1	130970. 0	
$3s\ 3p^3$	$3p^3\ ^1D°$	2	*77710. 8*			7	2	131320. 5	
$3s^2\,3p(^2P°)4s$	$4s\ ^3P°$	0	*86599. 0*	146. 1		8	1, 2	131601. 9	
		1	*86745. 1*	381. 0		9	2	131633. 1	
		2	*87126. 1*			10	?	131652. 1?	
$3s^2\,3p(^2P°)4s$	$4s\ ^1P°$	1	*88893. 5*		$3s^2\,3p(^2P°)4d$	$4d\ ^1P°$	1	*131729. 1*	
$3s\ 3p^3$	$3p^3\ ^1P°$	1	*102798. 4*		$3s^2\,3p(^2P°)4d$	$4d\ ^1F°$	3	*131764. 4*	
$3s^2\,3p(^2P°)4p$	$4p\ ^3D$	1	103166. 7	173. 5	$3s^2\,3p(^2P°)4f$	11 (4f ^{1}D?)	2	132082. 4	
		2	103340. 2	328. 7		12	2, 3	132134. 1	
		3	103668. 9			13	2	132163. 6	
$3s^2\,3p(^2P°)3d$	$3d\ ^3P°$	2	*103632. 3*	−123. 1		14	2	132206. 9	
		1	*103755. 4*	−464	$3s^2\,3p(^2P°)4f$	15 (4f ^{1}F?)	3	132236. 0	
		0	*104219?*			16	2, 3	132354. 7	
$3s^2\,3p(^2P°)3d$	$3d\ ^3D°$	1	*103935. 8*	117. 4		17	1	132371. 2	
		2	*104053. 2*	48. 2		18	2	132397. 0	
		3	*104101. 4*		$3s^2\,3p(^2P°)5p$	19 (5p ^{1}S?)	0, 1	132641. 5?	
$3s^2\,3p(^2P°)4p$	$4p\ ^3P$	0	105225. 5	78. 1		20	1	133418. 8?	
		1	105303. 6	247. 3	$3s^2\,3p(^2P°)6s$	$6s\ ^3P°$	0	*137433*	53
		2	105550. 9				1	*137486*	514
$3s^2\,3p(^2P°)3d$	$3d\ ^1D°$	2	*105963. 1*				2	*138000*	
$3s^2\,3p(^2P°)4p$	$4p\ ^3S$	1	106002. 5		$3s^2\,3p(^2P°)6s$	$6s\ ^1P°$	1	*138058. 4*	
$3s^2\,3p(^2P°)4p$	$4p\ ^1D$	2	107924. 2		$3s^2\,3p(^2P°)5d$	$5d\ ^3P°$	0		
$3s^2\,3p(^2P°)3d$	$3d\ ^1P°$	1	*108371. 8*				1		
$3s^2\,3p(^2P°)4p$	$4p\ ^1P$	1	108417. 4				2	*139091. 9*	
$3s\ 3p^3$	$3p^3\ ^3S°$	1	*110254. 9*		$3s^2\,3p(^2P°)6d$	$6d\ ^3P°$	0		
	2°	2, 3	*110456. 9?*				1		
$3s^2\,3p(^2P°)4p$	$4p\ ^1S$	0	111114. 8				2	*145519. 8*	
$3s^2\,3p(^2P°)5s$	$5s\ ^3P°$	0	*123345. 4*	111. 3	P III ($^2P°_{1/2}$)	*Limit*	-----	**158550. 0**	
		1	*123456. 7*	435. 3	$3s\,3p^2(^4P)3d$	$3d\ ^5P$	3	*160018. 2+x*	−126. 5
		2	*123892. 0*				2	*160144. 7+x*	−90. 5
$3s^2\,3p(^2P°)5s$	$5s\ ^1P°$	1	*124433. 8*				1	*160235. 2+x*	
$3s^2\,3p(^2P°)4d$	$4d\ ^3F°$	2	*124955. 9*	174. 7					
		3	*125130. 6*	262. 1					
		4	*125392. 7*						

October 1947.

P II Observed Terms*

Config. 1s² 2s² 2p⁶+	Observed Terms					
$3s^2\,3p^2$	{ $3p^2\,{}^1S$	$3p^2\,{}^3P$	$3p^2\,{}^1D$			
$3s\,3p^3$	{ $3p^3\,{}^5S^\circ$ $3p^3\,{}^3S^\circ$	$3p^3\,{}^3P^\circ$ $3p^3\,{}^1P^\circ$	$3p^3\,{}^3D^\circ$ $3p^3\,{}^1D^\circ$			

	$ns\ (n\geq 4)$	$np\ (n\geq 4)$			$nd\ (n\geq 3)$		
$3s^2\,3p(^2P^\circ)nx$	{ $4\text{–}6s\ {}^3P^\circ$ $4\text{–}6s\ {}^1P^\circ$	$4p\ {}^3S$ $4p\ {}^1S$	$4p\ {}^3P$ $4p\ {}^1P$	$4p\ {}^3D$ $4p\ {}^1D$	$3\text{–}6d\ {}^3P^\circ$ $3,4d\ {}^1P^\circ$	$3,4d\ {}^3D^\circ$ $3,4d\ {}^1D^\circ$	$4d\ {}^3F^\circ$ $4d\ {}^1F^\circ$
$3s\,3p^2(^4P)nx$					$3d\ {}^5P$		

*For predicted terms in the spectra of the Si I isoelectronic sequence, see Introduction.

P III

(Al I sequence; 13 electrons) $Z=15$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\ {}^2P^\circ_{1/2}$

$3p\ {}^2P^\circ_{1/2}\ 243290.0$ cm⁻¹   I. P. 30.156±0.003 volts

The terms have been taken from Robinson, who has revised and extended the earlier work on analysis. An evident misprint has been corrected here, i. e., the absolute term values of $4f\ {}^4D$ should have been printed as negative.

Robinson has classified two lines as the intersystem combination $3p\ {}^2P^\circ-3p^2\ {}^4P$. He remarks that these must be considered as tentative classifications, but that they are consistent with the analagous transition in Al I.

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H. A. Robinson, Phys. Rev. **51,** 726 (1937). (I P) (T) (C L)

P III

Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$3p\ ^2P°$	½ / 1½	0.0 / 559.6	559.6
$3s\ 3p^2$	$3p^2\ ^4P$	½ / 1½ / 2½	56919.3 / 57125.8 / 57454.5	206.5 / 328.7
$3s\ 3p^2$	$3p^2\ ^2D$	1½ / 2½	74915.1 / 74944.6	29.5
$3s\ 3p^2$	$3p^3\ ^2S$	½	100201.2	
$3s\ 3p^2$	$3p^2\ ^2P$	½ / 1½	109035.7 / 109409.7	374.0
$3s^2(^1S)3d$	$3d\ ^2D$	1½ / 2½	116873.6 / 116884.9	11.3
$3s^2(^1S)4s$	$4s\ ^2S$	½	117834.5	
$3s^2(^1S)4p$	$4p\ ^2P°$	½ / 1½	141375.7 / 141512.8	137.1
$3p^3$	$3p^3\ ^2D°$	1½ / 2½	147322.4 / 147384.3	61.9
$3p^3$	$3p^3\ ^4S°$	1½	159714.6	
$3p^3$	$3p^3\ ^2P°$	1½ / ½	170107.2 / 170167.0	−59.8
$3s^2(^1S)4d$	$4d\ ^2D$	{ 1½ / 2½ }	172429.2	
$3s\ 3p(^3P°)3d$	$3d\ ^4P°$	2½ / 1½ / ½	173813.4 / 173988.4 / 174106.2	−175.0 / −117.8
$3s\ 3p(^3P°)3d$	$3d\ ^4D°$	½ / 1½ / 2½ / 3½	175260.8 / 175314.1 / 175376.6 / 175427.2	53.3 / 62.5 / 50.6
$3s^2(^1S)5s$	$5s\ ^2S$	½	176041.0	
$3s^2(^1S)4f$	$4f\ ^2F°$	{ 2½ / 3½ }	178653.2	

Config.	Desig.	J	Level	Interval
$3s\ 3p(^3P°)4s$	$4s\ ^4P°$	½ / 1½ / 2½	184453.4 / 184639.3 / 185045.2	185.9 / 405.9
$3s\ 3p(^3P°)3d$	$^21°$	1½	184854.1	
$3s\ 3p(^3P°)4s$	$4s\ ^2P°$	½ / 1½	186920.7	
$3s^2(^1S)5p$	$5p\ ^2P°$	½ / 1½	191639.5	
$3s^2(^1S)5d$	$5d\ ^2D$	{ 1½ / 2½ }	200442.8	
$3s^2(^1S)6s$	$6s\ ^2S$	½	201103.4	
$3s^2(^1S)5f$	$5f\ ^2F°$	{ 2½ / 3½ }	202906.4	
$3s^2(^1S)5g$	$5g\ ^2G$	{ 3½ / 4½ }	203782.7	
$3s\ 3p(^3P°)4p$	$4p\ ^4P$	½ / 1½ / 2½	209938.9 / 210055.8 / 210306.1	116.9 / 250.3
$3s\ 3p(^3P°)4p$	$4p\ ^4S$	1½	211339.4	
$3s^2(^1S)6d$	$6d\ ^2D$	{ 1½ / 2½ }	213982.8	
$3s^2(^1S)6f$	$6f\ ^2F°$	{ 2½ / 3½ }	215402.0	
$3s^2(^1S)6g$	$6g\ ^2G$	{ 3½ / 4½ }	215863.2	
$3s^2(^1S)7g$	$7g\ ^2G$	{ 3½ / 4½ }	223131.0	
P IV ($^1S_0$)	Limit	--------	243290.0	
$3s\ 3p(^3P°)4f$	$4f\ ^4D$	3½ / 2½ / 1½ / ½	248168.4 / 248199.4 / 248228.4 / 248265.5	−31.0 / −29.0 / −37.1

September 1947.

P III Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms				
$3s^2(^1S)3p$	$3p\ ^2P°$				
$3s\ 3p^2$	$3p^2\ ^2S$ $3p^2\ ^4P$ / $3p^2\ ^2P$ $3p^2\ ^2D$				
$3p^3$	$3p^3\ ^4S°$ / $3p^3\ ^2P°$ $3p^3\ ^2D°$				

	ns (n ≥ 4)	np (n ≥ 4)	nd (n ≥ 3)	nf (n ≥ 4)	ng (n ≥ 5)
$3s^2(^1S)nx$	4–6s ^2S	4–5p $^2P°$	3–6d ^2D	4–6f $^2F°$	5–7g ^2G
$3s\ 3p(^3P°)nx$	{ 4s $^4P°$ / 4s $^2P°$	4p ^4S 4p ^4P	3d $^4P°$ 3d $^4D°$	4f $^4D°$	

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

P IV

(Mg I sequence; 12 electrons) $Z=16$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,{}^1S_0$

$3s^2\,{}^1S_0$ **414312.4** cm⁻¹   I. P. 51.354 ±0.013 volts

The analysis published by Bowen in 1932 has been extended by Robinson to include a total of 105 classified lines in the range from 283 A to 4291 A.

Intersystem combinations connecting the singlet and triplet terms have been observed. Robinson remarks that the observed combination $3s^2\,{}^1S_0-3p\,{}^3P_1^\circ$ obeys the irregular doublet law very well.

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H. A. Robinson, Phys. Rev. **51, 727** (1937).   (I P) (T) (C L)

P IV

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
3s²	3s² ¹S	0	0. 0		3s(²S)4d	4d ¹D	2	296757. 8	
3s(²S)3p	3p ³P°	0	67911. 6	227. 4	3p(²P°)3d	3d ¹P°	1	298327	
		1	68139. 0	468. 4	3s(²S)4f	4f ³F°	2	303115	235
		2	68607. 4				3	303350	309
3s(²S)3p	3p ¹P°	1	105189. 9				4	303659	
3s(²S)3d	3d ¹D	2	158138. 2		3s(²S)5s	5s ³S	1	309102. 4	
3p²	3p² ³P	0	164935	243	3p(²P°)4s	4s ¹P°	1	313078	
		1	165178	468	3s(²S)5s	5s ¹S	0	316627. 0	
		2	165646		3p(²P°)4s	4s ³P°	0	317662	286
3p²	3p² ¹D	2	166144				1	317948	405
3s(²S)3d	3d ³D	3, 2, 1	189389. 0				2	318353	
3p²	3p² ¹S	0	194588. 5		3s(²S)5p	5p ³P°	0		73
3s(²S)4s	4s ³S	1	226888. 6				1	320053	
3s(²S)4s	4s ¹S	0	233995. 0				2	320126	
3s(²S)4p	4p ³P°	0	256544. 1	58. 6	3s(²S)5p	5p ¹P°	1	320063. 5	
		1	256602. 7	148. 6	3s(²S)5d	5d ³D	3	339635. 5	−3. 8
		2	256751. 3				2	339639. 3	−2. 8
3s(²S)4p	4p ¹P°	1	257520. 2				1	339642. 1	
3p(²P°)3d	3d ¹F°	3	276270?		3s(²S)5d	5d ¹D	2	341004. 8?	
3p(²P°)3d	3d ¹D°	2	276325?		3s(²S)5f	5f ³F°	2		281
3p(²P°)3d	3d ³P°	2	281011	−240			3	343309	
		1	281251	−140			4	343590	
		0	281391		3s(²S)5g	5g ³G	3, 4, 5	343688	
3p(²P°)3d	3d ³D°	1	283142	97	3s(²S)6s	6s ³S	1	346672	
		2	283239	82	3s(²S)6p	6p ¹P°	1	352125?	
		3	283321		P v (²S½)	Limit	---------	414312. 4	
3s(²S)4d	4d ³D	1	293233. 5	5. 4					
		2	293238. 9	7. 7					
		3	293246. 6						

July 1947.

P IV Observed Terms*

Config. $1s^2\, 2s^2\, 2p^6+$	Observed Terms				
$3s^2$	$3s^2$ ¹S				
$3s(^2S)3p$	$\{$	$3p$ ³P° $3p$ ¹P°			
$3p^2$	$\{$ $3p^2$ ¹S	$3p^2$ ³P $\quad 3p^2$ ¹D			

	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$	$nf\ (n\geq 4)$	$ng\ (n\geq 5)$
$3s(^2S)nx$	$\{$4–6s ³S 4, 5s ¹S	4, 5p ³P° 4–6p ¹P°	3–5d ³D 3–5d ¹D	4, 5f ³F°	5g ³G
$3p(^2P°)nx$	$\{$ 4s ³P° 4s ¹P°		3d ³P° $\quad$ 3d ³D° 3d ¹P° $\quad$ 3d ¹D° $\quad$ 3d ¹F°		

* For predicted terms in the spectra of the Mg ɪ isoelectronic sequence, see Introduction.

P v

(Na ɪ sequence; 11 electrons) $\hspace{4cm}$ $Z=15$

Ground state $1s^2\, 2s^2\, 2p^6\, 3s\ ^2S_{\frac{1}{2}}$

$3s\ ^2S_{\frac{1}{2}}$ **524462.9** cm⁻¹ $\hspace{4cm}$ I. P. 65.007±0.003 volts

The analysis is from Robinson who has extended the earlier work by Bowen and Millikan. The total number of classified lines is 38, of which 31 are in the range between 210 A and 1610 A. The absolute value of $6h\ ^2H°$ was extrapolated along the Na ɪ isoelectronic sequence.

REFERENCE

H. A. Robinson, Phys. Rev. **51**, 732 (1937). (I P) (T) (C L)

P v $\hspace{10cm}$ P v

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
3s	3s ²S	½	0. 0		6s	6s ²S	½	427157	
3p	3p ²P°	½ 1½	88651. 7 89446. 3	794. 6	6p	6p ²P°	½ 1½	435100. 4	
3d	3d ²D	1½ 2½	204197. 1 204208. 3	11. 2	6d	6d ²D	$\{$1½ 2½$\}$	445814	
4s	4s ²S	½	272961. 1		6f	6f ²F°	$\{$2½ 3½$\}$	448061. 7	
4p	4p ²P°	½ 1½	304161. 3 304445. 3	284. 0	6g	6g ²G	$\{$3½ 4½$\}$	448216. 8	
4d	4d ²D	1½ 2½	345398. 4 345403. 3	4. 9	6h	6h ²H°	$\{$4½ 5½$\}$	448247. 4	
4f	4f ²F°	$\{$2½ 3½$\}$	352595. 3		7s	7s ²S	½	455573	
5s	5s ²S	½	376639. 2		7p	7p ²P°	$\{$½ 1½$\}$	460363	
5p	5p ²P°	½ 1½	391101. 7 391242. 4	140. 7	7d	7d ²D	$\{$1½ 2½$\}$	466893	
5d	5d ²D	$\{$1½ 2½$\}$	410631. 1		7f	7f ²F°	$\{$2½ 3½$\}$	468530	
5f	5f ²F°	$\{$2½ 3½$\}$	414458. 7		8p	8p ²P°	$\{$½ 1½$\}$	476181	
5g	5g ²G	$\{$3½ 4½$\}$	414684. 4						
					P vɪ (¹S₀)		Limit	524462. 9	

June 1947.

P VI

(Ne I sequence; 10 electrons) $Z=15$

Ground state $1s^2\,2s^2\,2p^6\,{}^1S_0$

$2p^6\,{}^1S_0$ **1778250** cm^{-1} I. P. 220.414 volts

The analysis is by Robinson who has generously furnished his manuscript in advance of publication. He has classified 23 lines in the range 57 A to 91 A, as combinations with the ground term. The term designations he assigns on the assumption of *LS*-coupling are given in the table under the heading "Author".

As for Ne I, the *jl*-coupling notation in the general form suggested by Racah is introduced. A predicted value of $7d\,[1\tfrac{1}{2}]^\circ$, is entered in brackets in the table, since the observed combination is a blend.

REFERENCES

G. Racah, Phys. Rev. **61**, 537 (L) (1942).
H. A. Robinson, unpublished material (June 1947).   (I P) (T) (C L)

P VI

Author	Config.	Desig.	J	Level	Author	Config.	Desig.	J	Level
$2p\,{}^1S_0$	$2p^6$	$2p^6\,{}^1S$	0	0	$5s\,{}^1P_1$	$2p^5({}^2P^\circ_{\frac{1}{2}})5s$	$5s'[\,\tfrac{1}{2}]^\circ$	0 1	1582860
$3s\,{}^3P_1$	$2p^5({}^2P^\circ_{1\frac{1}{2}})3s$	$3s\,[1\tfrac{1}{2}]^\circ$	2 1	1093240	$5d\,{}^3P_1$	$2p^5({}^2P^\circ_{1\frac{1}{2}})5d$	$5d\,[\,\tfrac{1}{2}]^\circ$	0 1	1613680
$3s\,{}^1P_1$	$2p^5({}^2P^\circ_{\frac{1}{2}})3s$	$3s'[\,\tfrac{1}{2}]^\circ$	0 1	1103180	$5d\,{}^1P_1$	''	$5d\,[1\tfrac{1}{2}]^\circ$	1	1616320
$3d\,{}^3P_1$	$2p^5({}^2P^\circ_{1\frac{1}{2}})3d$	$3d\,[\,\tfrac{1}{2}]^\circ$	0 1	1306610	$5d\,{}^3D_1$	$2p^5({}^2P^\circ_{\frac{1}{2}})5d$	$5d'[1\tfrac{1}{2}]^\circ$	1	1622800
$3d\,{}^1P_1$	''	$3d\,[1\tfrac{1}{2}]^\circ$	1	1321910	$6s\,{}^1P_1$	$2p^5({}^2P^\circ_{\frac{1}{2}})6s$	$6s'[\,\tfrac{1}{2}]^\circ$	0 1	1650930
$3d\,{}^3D_1$	$2p^5({}^2P^\circ_{\frac{1}{2}})3d$	$3d'[1\tfrac{1}{2}]^\circ$	1	1334210	$6d\,{}^1P_1$	$2p^5({}^2P^\circ_{1\frac{1}{2}})6d$	$6d\,[1\tfrac{1}{2}]^\circ$	1	1666220
$4s\,{}^3P_1$	$2p^5({}^2P^\circ_{1\frac{1}{2}})4s$	$4s\,[1\tfrac{1}{2}]^\circ$	2 1	1439840	$6d\,{}^3D_1$	$2p^5({}^2P^\circ_{\frac{1}{2}})6d$	$6d'[1\tfrac{1}{2}]^\circ$	1	1672940
$4s\,{}^1P_1$	$2p^5({}^2P^\circ_{\frac{1}{2}})4s$	$4s'[\,\tfrac{1}{2}]^\circ$	0 1	1446740	$7d\,{}^1P_1$	$2p^5({}^2P^\circ_{1\frac{1}{2}})7d$	$7d\,[1\tfrac{1}{2}]^\circ$	1	[1696180]
$4d\,{}^3P_1$	$2p^5({}^2P^\circ_{1\frac{1}{2}})4d$	$4d\,[\,\tfrac{1}{2}]^\circ$	0 1	1516530	$7d\,{}^3D_1$	$2p^5({}^2P^\circ_{\frac{1}{2}})7d$	$7d'[1\tfrac{1}{2}]^\circ$	1	1702790
$4d\,{}^1P_1$	''	$4d\,[1\tfrac{1}{2}]^\circ$	1	1523460	$8d\,{}^1P_1$	$2p^5({}^2P^\circ_{1\frac{1}{2}})8d$	$8d\,[1\tfrac{1}{2}]^\circ$	1	1715440
$4d\,{}^3D_1$	$2p^5({}^2P^\circ_{\frac{1}{2}})4d$	$4d'[1\tfrac{1}{2}]^\circ$	1	1531210	$9d\,{}^1P_1$	$2p^5({}^2P^\circ_{1\frac{1}{2}})9d$	$9d\,[1\tfrac{1}{2}]^\circ$	1	1726160
$5s\,{}^3P_1$	$2p^5({}^2P^\circ_{1\frac{1}{2}})5s$	$5s\,[1\tfrac{1}{2}]^\circ$	2 1	1576040	P VII $({}^2P^\circ_{1\frac{1}{2}})$	*Limit*	-------	1778250
					P VII $({}^2P^\circ_{\frac{1}{2}})$	*Limit*	-------	1785518

June 1947.

P VI Observed Levels*

Config. $1s^2\,2s^2+$	Observed Terms		
$2p^6$	$2p^6$ ¹S		
	$ns\ (n\geq 3)$	$nd\ (n\geq 3)$	
$2p^5(^2\mathrm{P}°)nx$	$\Big\{$ 3–5s ³P° 3–6s ¹P°	3–5d ³P° 3–9d ¹P°	3–7d ³D°

jl-Coupling Notation

	Observed Pairs	
	$ns\ (n\geq 3)$	$nd\ (n\geq 3)$
$2p^5(^2\mathrm{P}^o_{1\frac{1}{2}})nx$	3–5s [1½]°	3–5d [½]° 3–9d [1½]°
$2p^5(^2\mathrm{P}^o_{\frac{1}{2}})nx'$	3–6s′ [½]°	3–7d′ [1½]°

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

P VII

(F I sequence; 9 electrons) $Z=15$

Ground state $1s^2\,2s^2\,2p^5\ ^2\mathrm{P}^o_{1\frac{1}{2}}$

$2p^5\ ^2\mathrm{P}^o_{1\frac{1}{2}}$ *2124300* cm⁻¹   I. P. 263.31 volts

    The analysis is by Robinson, who has generously furnished his manuscript in advance of publication. He has classified more than 70 lines in the region between 49 A and 223 A.
    Intersystem combinations connecting the doublet and quartet terms have been observed.

REFERENCE

H. A. Robinson, unpublished material (March 1948). (I P) (T) (C L)

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$2s^2\,2p^5$	$2p^5$ ²P°	1½ / ½	0 / *7268*	−7268	$2s^2\,2p^4(^3P)4s$	4s ²P	1½ / ½	1695720 / 1701380	−5660
$2s\,2p^6$	$2p^6$ ²S	½	454732		$2s^2\,2p^4(^1D)4s$	4s′ ²D	{ 2½ / 1½ }	1741710	
$2s^2\,2p^4(^3P)3s$	3s ⁴P	2½ / 1½ / ½	1259730 / 1264170 / 1266000?	−4440 / −1830	$2s^2\,2p^4(^3P)4d$	4d ²D	2½ / 1½	1775510 / 1784030	−8520
$2s^2\,2p^4(^3P)3s$	3s ²P	1½ / ½	1277380 / 1282550	−5170	$2s^2\,2p^4(^3P)4d$	4d ⁴P	½ / 1½ / 2½	1778690	
$2s^2\,2p^4(^1D)3s$	3s′ ²D	2½ / 1½	1317110		$2s^2\,2p^4(^3P)4d$	4d ²P	½ / 1½	1780190 / 1782260	2070
$2s^2\,2p^4(^1S)3s$	3s″ ²S	½	1375810		$2s^2\,2p^4(^1S)4s$	4s″ ²S	½	1801570	
$2s^2\,2p^4(^3P)3d$	3d ⁴P	2½ / 1½ / ½	1496890 / 1500040	−3150	$2s^2\,2p^4(^1D)4d$	4d′ ²P	1½ / ½	1827890 / 1829190	−1300
$2s^2\,2p^4(^3P)3d$	3d ⁴F	4½ / 3½ / 2½ / 1½	1498400		$2s^2\,2p^4(^1D)4d$	4d′ ²D	{ 2½ / 1½ }	1828630	
$2s^2\,2p^4(^3P)3d$	3d ²D	2½ / 1½	1502040 / 1506730	−4690	$2s^2\,2p^4(^1D)4d$	4d′ ²S	½	1830190	
$2s^2\,2p^4(^3P)3d$	3d ²P	½ / 1½	1505300 / 1511310	6010	$2s^2\,2p^4(^3P)5s$	5s ²P	1½ / ½	1865680	
$2s^2\,2p^4(^3P)3d$	3d ²F°	3½ / 2½	1510050		$2s^2\,2p^4(^1S)4d$	4d″ ²D	{ 2½ / 1½ }	1885000	
$2s^2\,2p^4(^1D)3d$	3d′ ²P	½ / 1½	1548480 / 1552170	3690	$2s^2\,2p^4(^1S)5s$	5s″ ²S	½	1913620	
$2s^2\,2p^4(^1D)3d$	3d′ ²F	3½ / 2½	1552120		$2s\,2p^5(^3P°)3d$	3d‴ 1°		*1919310?*	
$2s^2\,2p^4(^1D)3d$	3d′ ²D	2½ / 1½	1553740 / 1554420	−680	$2s\,2p^5(^3P°)3d$	3d‴ 2°		*1921010?*	
$2s^2\,2p^4(^1D)3d$	3d′ ²S	½	1555560		$2s\,2p^5(^3P°)3d$	3d‴ 3°		*1922150?*	
$2s^2\,2p^4(^1S)3d$	3d″ ²D	2½ / 1½	1606550 / 1606880	−330	$2s\,2p^5(^3P°)3d$	3d‴ 4°		*1925560?*	
					$2s\,2p^5(^3P°)3d$	3d‴ 5°		*1931070?*	
$2s\,2p^5(^3P°)3s$	3s‴ ²P°	1½ / ½	*1692160* / *1696860*	−4700	$2s^2\,2p^4(^1S)5d$	5d″ ²D	{ 2½ / 1½ }	2013690	
					P VIII (³P₂)	*Limit*	--------	*2124300*	

March 1948.

P VII Observed Terms*

Config. 1s²+	Observed Terms				
$2s^2\,2p^5$	2p⁵ ²P°				
$2s\,2p^6$	2p⁶ ²S				
	ns (n≥3)		**nd (n≥3)**		
$2s^2\,2p^4(^3P)nx$	3s ⁴P / 3–5s ²P		3,4d ⁴P / 3,4d ²P	3,4d ²D	3d ⁴F / 3d ²F
$2s^2\,2p^4(^1D)nx'$		3,4s′ ²D	3,4d′ ²S	3,4d′ ²P	3,4d′ ²D	3d′ ²F
$2s^2\,2p^4(^1S)nx''$	3–5s″ ²S		3–5d″ ²D		
$2s\,2p^5(^3P°)nx'''$	3s‴ ²P°				

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

P VIII

(O I sequence; 8 electrons) $Z=15$

Ground state $1s^2 2s^2 2p^4 \, {}^3P_2$

$2p^4 \, {}^3P_2$ **2495000 cm^{-1}** I. P. 309.26 volts

The terms are from an unpublished manuscript kindly furnished by Robinson. No intersystem combinations have been observed and the uncertainty, x, may be considerable.
The unit adopted by Robinson, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

H A. Robinson, unpublished material (March 1948).   (I P) (T)

<div style="text-align:center">P VIII   P VIII</div>

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$2s^2 2p^4$	$2p^4 \, {}^3P$	2 1 0	0 5757 7826	−5757 −2069	$2s^2 2p^3({}^2P°)3d$	$3d''\, {}^3F°$	4 3 2	1790480 1795030	−4550
$2s^2 2p^4$	$2p^4 \, {}^1D$	2	52450+x		$2s^2 2p^3({}^2P°)3d$	$3d''\, {}^1D°$	2	1795430+x	
$2s^2 2p^4$	$2p^4 \, {}^1S$	0	110970+x		$2s^2 2p^3({}^2P°)3d$	$3d''\, {}^3D°$	3 2 1	1796240 1800770	−4530
$2s\ 2p^5$	$2p^5 \, {}^3P°$	2 1 0	403806 408913 411736	−5107 −2823	$2s^2 2p^3({}^2P°)3d$	$3d''\, {}^1P°$	1	1800760+x	
$2s\ 2p^5$	$2p^5 \, {}^1P°$	1	560680+x		$2s^2 2p^3({}^2P°)3d$	$3d''\, {}^1F°$	3	1804930+x	
$2s^2 2p^3({}^4S°)3s$	$3s\ {}^3S°$	1	1462340		$2s^2 2p^3({}^4S°)4s$	$4s\ {}^3S°$	1	1958370	
$2s^2 2p^3({}^2D°)3s$	$3s'\ {}^3D°$	1, 2 3	1519740 1520030	290	$2s^2 2p^3({}^2D°)4s$	$4s'\ {}^3D°$	1 2 3	2029470	
$2s^2 2p^3({}^2D°)3s$	$3s'\ {}^1D°$	2	1532020+x		$2s^2 2p^3({}^2D°)4s$	$4s'\ {}^1D°$	2	2033320+x	
$2s^2 2p^3({}^2P°)3s$	$3s''\ {}^3P°$	0 1 2	1559500 1560070 1561260	570 1190	$2s^2 2p^3({}^4S°)4d$	$4d\ {}^3D°$	1 2 3	2046710	
$2s^2 2p^3({}^2P°)3s$	$3s''\ {}^1P°$	1	1573270+x		$2s^2 2p^3({}^2P°)4s$	$4s''\ {}^1P°$	1	2073760+x	
$2s^2 2p^3({}^4S°)3d$	$3d\ {}^3D°$	1, 2 3	1685980 1686280	300	$2s^2 2p^3({}^2D°)4d$	$4d'\ {}^3D°$	3, 2, 1	2115510	
$2s^2 2p^3({}^2D°)3d$	$3d'\ {}^3F°$	4, 3, 2	1749870		$2s^2 2p^3({}^2D°)4d$	$4d'\ {}^3P°$	2 1 0	2119360	
$2s^2 2p^3({}^2D°)3d$	$3d'\ {}^3D°$	3, 2, 1	1753090						
$2s^2 2p^3({}^2D°)3d$	$3d'\ {}^1P°$	1	1753830+x		$2s^2 2p^3({}^2D°)4d$	$4d'\ {}^3S°$	1	2122020	
$2s^2 2p^3({}^2D°)3d$	$3d'\ {}^3P°$	2 1 0	1760530 1762400	−1870	$2s^2 2p^3({}^2D°)4d$	$4d'\ {}^1F°$	3	2123570+x	
					$2s^2 2p^3({}^4S°)5d$	$5d\ {}^3D°$	1 2 3	2210630	
$2s^2 2p^3({}^2D°)3d$	$3d'\ {}^1D°$	2	1761680+x						
$2s^2 2p^3({}^2D°)3d$	$3d'\ {}^3S°$	1	1767880		$2s^2 2p^3({}^2D°)5s$	$5s'\ {}^1D°$	1	2240920+x	
$2s^2 2p^3({}^2D°)3d$	$3d'\ {}^1F°$	3	1776050+x						
$2s^2 2p^3({}^2P°)3d$	$3d''\ {}^3P°$	0 1 2	1787090 1788090 1789690	1000 1600	P IX ($^4S^°_{1\frac{1}{2}}$)	*Limit*		2495000	

March 1948.

P VIII Observed Terms*

Config. 1s²+	Observed Terms			
2s² 2p⁴	{ 2p⁴ ¹S	2p⁴ ³P	2p⁴ ¹D	
2s 2p⁵	{	2p⁵ ³P° 2p⁵ ¹P°		

	ns (n≥3)		nd (n≥3)			
2s² 2p³(⁴S°)nx	3, 4s ³S°				3–5d ³D°	
2s² 2p³(²D°)nx'	{	3, 4s' ³D° 3–5s' ¹D°	3, 4d' ³S°	3, 4d' ³P° 3d' ¹P°	3, 4d' ³D° 3d' ¹D°	3d' ³F° 3, 4d' ¹F°
2s² 2p³(²P°)nx''	{	3s'' ³P° 3, 4s'' ¹P°		3d'' ³P° 3d'' ¹P°	3d'' ³D° 3d'' ¹D°	3d'' ³F° 3d'' ¹F°

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

P IX

(N I sequence; 7 electrons) $Z=15$

Ground state $1s^2\, 2s^2\, 2p^3\, {}^4S^\circ_{1\frac{1}{2}}$

$2p^3\, {}^4S^\circ_{1\frac{1}{2}}\, \mathit{3006200}$ cm⁻¹   I. P. 372.62 volts

The analysis is by Robinson, who has kindly furnished a manuscript copy in advance of publication. He has found 35 terms, and classified more than 100 lines in the region between 40 A and 314 A. Intersystem combinations connecting the doublet and quartet systems of terms have been observed.

REFERENCE

H. A. Robinson, unpublished material (March 1948). (I P) (T) (C L)

P IX

Config.	Desig.	J	Level	Internal
2s² 2p³	2p³ ⁴S°	1½	0	
2s² 2p³	2p³ ²D°	1½ 2½	73167 73730	563
2s² 2p³	2p³ ²P°	½ 1½	113457 114430	973
2s 2p⁴	2p⁴ ⁴P	2½ 1½ ½	345390 350440 353050	−5050 −2610
2s 2p⁴	2p⁴ ²D	2½ 1½	472580 473090	−510
2s 2p⁴	2p⁴ ²S	½	552540	
2s 2p⁴	2p⁴ ²P	1½ ½	580710 587010	−6300

P IX

Config.	Desig.	J	Level	Interval
2p⁵	2p⁵ ²P°	1½ ½	898220 904700	−6480
2s² 2p²(³P)3s	3s ⁴P	½ 1½ 2½	1744000 1746250 1751850	2250 5600
2s² 2p²(³P)3s	3s ²P	½ 1½	1764370 1768970	4600
2s² 2p²(¹D)3s	3s' ²D	1½ 2½	1805940 1807340	1400
2s² 2p²(³P)3d	3d ²P	1½ ½	1962630 1963830	−1200
2s 2p³(⁵S°)3s	3s''' ⁴S°	1½	1965970	
2s² 2p²(³P)3d	3d ²F	2½ 3½	1970380 1976610	6230

P IX—Continued

Config.	Desig.	J	Level	Interval
2s² 2p²(³P)3d	3d ⁴D	½ 1½ 2½ 3½	1973870 1975970	2100
2s² 2p²(³P)3d	3d ⁴P	2½ 1½ ½	1977830 1979750 1980870	−1920 −1120
2s² 2p²(³P)3d	3d ²D	1½ 2½	2000360 2001960	1600
2s² 2p²(¹D)3d	3d' ²F	2½ 3½	2028530	
2s² 2p²(¹D)3d	3d' ²D	1½ 2½	2031610	
2s² 2p²(¹D)3d	3d' ²P	½ 1½	2038670 2042470	3800
2s 2p³(⁵S°)3p	3p''' ⁴P	½ to 2½	2043950	
2s² 2p²(¹D)3d	3d' ²S	½	2049150	
2s² 2p²(¹S)3d	3d'' ²D	1½ 2½	2079720	
2s 2p³(³D°)3s	3sIV ²D°	1½ 2½	2103110	
2s 2p³(⁵S°)3d	3d''' ⁴D°	½ to 3½	2161390	

P IX—Continued

Config.	Desig.	J	Level	Interval
2s 2p³(³D°)3p	3pIV ²F	2½ 3½	2224980	
2s 2p³(³D°)3d	3dIV ²F°	3½ 2½	2309530 2312530	−3000
2s² 2p²(³P)4s	4s ⁴P	½ 1½ 2½	2354100	
2s² 2p²(³P)4s	4s ²P	½ 1½	2354120 2359520	5400
2s² 2p²(³P)4d	4d ²F	2½ 3½	2430900 2436400	5500
2s² 2p²(³P)4d	4d ⁴P	½ to 2½	2435220	
2s² 2p²(³P)4d	4d ²D	1½ 2½	2441100	
2s² 2p²(¹D)4d	4d' ²F	2½ 3½	2480120	
2s² 2p²(¹D)4d	4d' ²D	1½ 2½	2487270	
2s² 2p²(¹S)4d	4d'' ²D	1½ 2½	2547080	
P x (³P₀)	Limit	--------	3006200	

March 1948.

P IX Observed Terms*

Config. 1s²+	Observed Terms			
2s² 2p³	2p³ ⁴S°	2p³ ²P°	2p³ ²D°	
2s 2p⁴	2p⁴ ²S	2p⁴ ⁴P 2p⁴ ²P	2p⁴ ²D	
2p⁵	2p⁵ ²P°			

Config. 1s²+	ns (n≥3)	np (n≥3)	nd (n≥3)			
2s² 2p²(³P)nx	3, 4s ⁴P; 3, 4s ²P		3, 4d ⁴P; 3d ²P	3d ⁴D; 3, 4d ²D	3, 4d ²F	
2s² 2p²(¹D)nx'	3s' ²D		3d' ²S; 3d' ²P	3, 4d' ²D	3, 4d' ²F	
2s² 2p²(¹S)nx''			3, 4d'' ²D			
2s 2p³(⁵S°)nx'''	3s''' ⁴S°	3p''' ⁴P	3d''' ⁴D°			
2s 2p³(³D°)nxIV	3sIV ²D°	3pIV ²F	3dIV ²F°			

*For predicted terms in the spectra of the N I isoelectronic sequence, see Introduction.

P x

(C I sequence; 6 electrons)   Z=15

Ground state ls² 2s² 2p² ³P₀

2p² ³P₀ 3432500 cm⁻¹   I. P. 425.46 volts

The analysis is from unpublished material kindly furnished by Robinson. He has found 36 terms and classified more than 70 lines in the region between 43 A and 318 A.

The singlet and triplet terms are connected by intersystem combinations. The connection of the quintet terms with the rest is based on Robinson's extrapolation of isoelectronic sequence data, as indicated by the uncertainty, x, and brackets in the table. The position of the level $2p^3\ ^3D_2^\circ$ is also extrapolated and entered in brackets.

REFERENCE

H. A. Robinson, unpublished material (March 1948).   (I P) (T) (C L)

P x   P x

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
2s² 2p²	2p² ³P	0 1 2	0 3390 8580	3390 5190	2s² 2p(²P°)3d	3d ³P°	2 1 0	2171630 2173040 2173990	−1410 −950
2s² 2p²	2p² ¹D	2	59330		2s 2p²(⁴P)3s	3s ³P	0 1 2	2178420 2182320 2188220	3900 5900
2s² 2p²	2p² ¹S	0	119430						
2s 2p³	2p³ ⁵S°	2	[166580]+x		2s² 2p(²P°)3d	3d ¹P°	1	2197500	
2s 2p³	2p³ ³D°	3 2 1	322790 [323010] 323160	[−220] −150	2s² 2p(²P°)3d	3d ¹F°	3	2197500	
					2s 2p²(⁴P)3p	3p ³S°	1	2216880	
2s 2p³	2p³ ³P°	2 1 0	379660		2s 2p²(⁴P)3p	3p ³D°	3 2 1	2262660 2267280 2269510	−4620 −2230
2s 2p³	2p³ ¹D°	2	484377		2s 2p²(⁴P)3p	3p ³P°	2 1 0	2275380 2281140 2286080?	−5760 −4940
2s 2p³	2p³ ³S°	1	490100						
2s 2p³	2p³ ¹P°	1	541090		2s 2p²(²D)3s	3s′ ³D	1, 2, 3	2281000	
2s² 2p(²P°)3s	3s ³P°	0 1 2	1954140 1955980 1963430	1840 7450	2s 2p²(¹D)3s	3s′ ¹D	2	2307970	
2s² 2p(²P°)3s	3s ¹P°	1	1976578		2s 2p²(⁴P)3d	3d ⁵D	0 1 2 3 4	2331040+x	
2s 2p²(⁴P)3s	3s ⁵P	1 2 3	2132450 +x 2135050 +x 2139320 +x	2600 4270					
2s² 2p(²P°)3d	3d ³F°	2 3 4	2140410		2s 2p²(⁴P)3d	3d ⁵P	3 2 1	2342240+x 2343760+x 2344970+x	−1520 −1210
2s² 2p(²P°)3d	3d ¹D°	2	2147190		2s 2p²(⁴P)3d	3d ³P	2 1 0	2345800 2351740 2354640	−5940 −2900
2s² 2p(²P°)3d	3d ³D°	1 2 3	2162410 2163500 2166800	1090 3300	2s 2p²(⁴P)3d	3d ³F	2 3 4	2355750 2358400 2362900	2650 4500

P x—Continued

Config.	Desig.	J	Level	Interval
2s 2p²(²D)3p	3p' ¹F°	3	*2371790*	
2s 2p²(²D)3p	3p' ¹D°	2	*2382480*	
2s 2p²(⁴P)3d	3d ³D	1	2385080	
		2	2387080	2000
		3	2388630	1550
2s 2p²(²D)3d	3d' ³F	2, 3, 4	2467290	
2s 2p²(²D)3d	3d' ³D	1, 2, 3	2476100	

P x—Continued

Config.	Desig.	J	Level	Interval
2s 2p²(²D)3d	3d' ¹D	2	2499250?	
2s 2p²(²D)3d	3d' ¹F	3	2499250?	
2s 2p²(²D)3d	3d' ³S	1	2509590?	
P xi ($^2P^\circ_{1/2}$)	*Limit*	--------	3432500	

March 1948.

Px Observed Terms*

Config. 1s²+	Observed Terms		
2s² 2p²	2p² ¹S 2p² ³P 2p² ¹D		
2s 2p³	2p³ ⁵S° 2p³ ³S° 2p³ ³P° 2p³ ³D° 2p³ ¹P° 2p³ ¹D°		

Config. 1s²+	*ns* (n ≥ 3)	*np* (n ≥ 3)	*nd* (n ≥ 3)
2s² 2p(²P°)nx	3s ³P° 3s ¹P°		3d ³P° 3d ³D° 3d ³F° 3d ¹P° 3d ¹D° 3d ¹F°
2s 2p²(⁴P)nx	3s ⁵P 3s ³P	3p ³S° 3p ³P° 3p ³D°	3d ⁵P 3d ⁵D 3d ³P 3d ³D 3d ³F
2s 2p²(²D)nx'	3s' ³D 3s' ¹D	3p' ¹D° 3p' ¹F°	3d' ³S 3d' ³D 3d' ³F 3d' ¹D 3d' ¹F

*For predicted terms in the spectra of the C i isoelectronic sequence, see Introduction.

P xi

(B i sequence; 5 electrons)   Z=15

Ground state 1s² 2s² 2p $^2P^\circ_{1/2}$

2p $^2P^\circ_{1/2}$ *3867500* cm⁻¹   I. P. 479.4 volts

The analysis is by Robinson, who has generously furnished his manuscript in advance of publication. He has classified 31 lines in the range from 42 A to 325 A. Some of the relative levels have been connected by a study of the behavior of the Rydberg denominators, rather than by the Ritz combination principle.

No intersystem combinations, connecting the doublet and quartet terms, have been observed, as indicated by x in the table. Robinson's extrapolated value of 2p² ⁴P_½ is entered in brackets.

REFERENCE

H. A. Robinson, unpublished material (Feb. 1948). (I P) (T) (C L)

P XI   **P XI**

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$2s^2(^1S)2p$	$2p$ $^2P°$	½ 1½	*0* *9700*	9700	$2s\,2p(^3P°)3d$	$3d$ $^2D°$	1½ 2½	*2539140* *2540050*	910
$2s\,2p^2$	$2p^2$ ^4P	½ 1½ 2½	$[177900]+x$ $181300+x$ $186400+x$	3400 5100	$2s\,2p(^1P°)3s$	$3s'$ $^2P°$	{ ½ 1½ }	*2541040*	
$2s\,2p^2$	$2p^2$ ^2D	{ 1½ 2½ }	317190		$2s\,2p(^3P°)3d$	$3d$ $^4P°$	½ 1½ 2½	*2547290* $+x$	
$2s\,2p^2$	$2p^2$ ^2S	½	403330		$2s\,2p(^3P°)3d$	$3d$ $^2F°$	2½ 3½	*2578000* *2584000*	6000
$2s\,2p^2$	$2p^2$ ^2P	½ 1½	425820 431650	5830	$2s\,2p(^3P°)3d$	$3d$ $^2P°$	1½ ½	*2589460* *2593090*	-3630
$2p^3$	$2p^3$ $^4S°$	1½	*559500* $+x$		$2s\,2p(^1P°)3d$	$3d'$ $^2F°$	{ 2½ 3½ }	*2697820*	
$2s^2(^1S)3s$	$3s$ ^2S	½	2174060		$2s\,2p(^1P°)3d$	$3d'$ $^2D°$	1½ 2½	*2707510* *2709400*	1890
$2s^2(^1S)3d$	$3d$ ^2D	1½ 2½	2347470 2348130	660	$2p^2(^3P)3d$	$3d''$ ^4P	2½ 1½ ½	*2856820* $+x$ *2858970* $+x$	-2150
$2s\,2p(^3P°)3s$	$3s$ $^4P°$	2½ 1½ ½	*2369930* $+x$ *2376130* $+x$ *2379730* $+x$	-6200 -3600					
$2s\,2p(^3P°)3s$	$3s$ $^2P°$	{ ½ 1½ }	*2410070*		P XII ($^1S_0$)	*Limit*		**3867500**	
$2s\,2p(^3P°)3d$	$3d$ $^4D°$	½ 1½ 2½ 3½	*2536000* $+x$ *2540500* $+x$	4500					

February 1948.

P XI Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2(^1S)2p$	$2p$ $^2P°$		
$2s\,2p^2$	{ $2p^2$ ^2S $2p^2$ ^4P $2p^2$ ^2P $2p^2$ ^2D		
$2p^3$	$2p^3$ $^4S°$		

	$ns\ (n\geq 3)$	$nd\ (n\geq 3)$	
$2s^2(^1S)nx$	$3s$ ^2S	$3d$ ^2D	
$2s\,2p(^3P°)nx$	{ $3s$ $^4P°$ $3s$ $^2P°$	$3d$ $^4P°$ $3d$ $^4D°$ $3d$ $^2P°$ $3d$ $^2D°$ $3d$ $^2F°$	
$2s\,2p(^1P°)nx'$	$3s'$ $^2P°$	$3d'$ $^2D°$ $3d'$ $^2F°$	
$2p^2(^3P)nx''$		$3d''$ ^4P	

*For predicted terms in the spectra of the B I isoelectronic sequence, see Introduction.

P XII Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2$	$2s^2$ ^{1}S		
$2s(^2S)2p$	$\{$ $\quad$ $2p$ ^{3}P° $\quad$ $2p$ ^{1}P°		
$2p^2$	$\{$ $\quad$ $2p^2$ ^{3}P $\quad\quad$ $2p^2$ ^{1}D		

	ns $(n \geq 3)$	np $(n \geq 3)$	nd $(n \geq 3)$
$2s(^2S)nx$	$\{$ $3s$ ^{3}S $\atop$ $3s$ ^{1}S	$3p$ ^{1}P°	$3d$ ^{3}D $\atop$ $3d$ ^{1}D
$2p(^2P°)nx$	$\{$ $\quad$ $3s$ ^{1}P°	$3p$ ^{1}P $\quad$ $3p$ ^{3}D $\atop$ $3p$ ^{1}D	$3d$ ^{1}P° $\quad$ $3d$ ^{3}D° $\atop$ $3d$ ^{1}D° $\quad$ $3d$ ^{1}F°

*For predicted terms in the spectra of the Be I isoelectronic sequence, see Introduction.

P XIII

(Li I sequence; 3 electrons) $Z=15$

Ground state $1s^2\ 2s\ ^2S_{1/2}$

$2s\ ^2S_{1/2}$ 4933060 cm^{-1} I. P. 611.45 volts

This spectrum is incompletely analyzed. Robinson has kindly furnished his unpublished manuscript giving seven classified lines; one at 110 A and six between 35 A and 38 A. The resonance lines have not been observed. The absolute value of the ground term has been extrapolated from isoelectronic sequence data. Similarly, other relative levels have been connected by a study of the Rydberg denominators in the isoelectronic sequence rather than by the Ritz combination principle.

REFERENCE

H. A. Robinson, unpublished material (Feb. 1948).   (I P) (T) (C L)

P XIII

Config.	Desig.	J	Level	Interval
$2s$	$2s$ ^{2}S	$\frac{1}{2}$	0	
$2p$	$2p$ ^{2}P°	$\frac{1}{2}$ $1\frac{1}{2}$	*207720* *219250*	11530
$3s$	$3s$ ^{2}S	$\frac{1}{2}$	2794900	
$3p$	$3p$ ^{2}P°	$\frac{1}{2}$ $1\frac{1}{2}$	*2844390* *2850150*	5760
$3d$	$3d$ ^{2}D	$1\frac{1}{2}$ $2\frac{1}{2}$	2870260 2871620	1360
$4f$	$4f$ ^{2}F°	$2\frac{1}{2}$ $3\frac{1}{2}$	*3772770?*	
------	------	------	------	
P XIV ($^1S_0$)	*Limit*	------	**4933060**	

February 1948.

SULFUR

S I

16 electrons $\qquad$ $Z=16$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^4\,{}^3P_2$

$3p^4\,{}^3P_2$ **83559.3** cm^{-1} $\qquad$ I. P. 10.357 volts

Edlén has revised and extended the earlier analyses and has generously furnished his manuscript term list in advance of publication, for inclusion here. Brackets denote values calculated from the series. For two such terms, however, $4f$ and $8f\,{}^5F$, combinations with $3d\,{}^5D°$ have been observed.

Intersystem combinations connecting terms of all three multiplicities, have been observed.

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S I

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^4$	$3p^4\ {}^3P$	2	0. 0	-396.8	$3s^2\,3p^3({}^2D°)4s$	$4s'\ {}^1D°$	2	69238. 7	
		1	396. 8	-176.8	$3s^2\,3p^3({}^4S°)3d$	$3d\ {}^3D°$	1	70165. 9	
		0	573. 6				2	70166. 8	0. 9
$3s^2\,3p^4$	$3p^4\ {}^1D$	2	9239. 0				3	70170. 7	3. 9
$3s^2\,3p^4$	$3p^4\ {}^1S$	0	22181. 4		$3s^2\,3p^3({}^4S°)5s$	$5s\ {}^5S°$	2	[70706]	
$3s^2\,3p^3({}^4S°)4s$	$4s\ {}^5S°$	2	*52623. 88*		$3s^2\,3p^3({}^4S°)5s$	$5s\ {}^3S°$	1	*71352. 5*	
$3s^2\,3p^3({}^4S°)4s$	$4s\ {}^3S°$	1	*55331. 15*		$3s\ 3p^5$	$3p^5\ {}^3P°$	2	*72025. 5*	-357.0
$3s^2\,3p^3({}^4S°)4p$	$4p\ {}^5P$	1	63446. 36				1	*72382. 5*	-189.9
		2	63457. 33	10. 97			0	*72572. 4*	
		3	63475. 26	17. 93	$3s^2\,3p^3({}^4S°)5p$	$5p\ {}^5P$	1	73911. 53	
$3s^2\,3p^3({}^4S°)4p$	$4p\ {}^3P$	0	64891. 71				2	73915. 16	3. 63
		1	64889. 23	-2.48			3	73921. 14	5. 98
		2	64892. 89	3. 66	$3s^2\,3p^3({}^4S°)5p$	$5p\ {}^3P$	2	74269. 20	
$3s^2\,3p^3({}^2D°)4s$	$4s'\ {}^3D°$	1	*67816. 87*				1	74270. 28	-1.08
		2	*67825. 72*	8. 85			0	74272. 32	-2.04
		3	*67843. 38*	17. 66	$3s^2\,3p^3({}^4S°)4d$	$4d\ {}^5D°$	4	*74973. 35*	
$3p^3({}^4S°)3d$	$3d\ {}^5D°$	4	*67878. 03*				3	*74974. 30*	-0.95
		3	*67890. 45*	-12.42			2	*74975. 43*	-1.13
		2	*67888. 25*	2. 20			1	*74976. 31*	-0.88
		1	*67885. 97*	2. 28			0	*74976. 90*	-0.59
		0	*67884. 67*	1. 30					

Config.	Desig.	J	Level	Interval
3s² 3p³(⁴S°)4d	4d ³D°	1	75952.16	0.51
		2	75952.67	4.13
		3	75956.80	
3s² 3p³(⁴S°)6s	6s ⁵S°	2	76464.26	
3s² 3p³(⁴S°)4f	4f ⁵F	5 to 1	[76653]	
3s² 3p³(⁴S°)4f	4f ³F	4, 3, 2	[76655]	
3s² 3p³(⁴S°)6s	6s ³S°	1	76720.90	
3s² 3p³(²P°)4s	4s'' ³P°	0	77136.10	14.49
		1	77150.59	30.82
		2	77181.41	
3s² 3p³(⁴S°)6p	6p ⁵P	1	77851.21	5.28
		2		
		3	77856.49	
3s² 3p³(⁴S°)6p	6p ³P	2	77891.10	
		1		
		0		
3s² 3p³(²D°)4p	4p' ³D	1	78152.45	−0.45
		2	78152.00	51.38
		3	78203.38	
3s² 3p³(⁴S°)5d	5d ⁵D°	4	78270.30	−0.42
		3, 2	78270.72	−0.47
		2, 1, 0	78271.19	
3s² 3p³(²P°)4s	4s'' ¹P°	1	78290.4	
3s² 3p³(²D°)4p	4p' ³F	2	78410.37	25.93
		3	78436.30	27.25
		4	78463.55	
3s² 3p³(²D°)4p	4p' ¹F	3	78638.2	
3s² 3p³(⁴S°)5d	5d ³D°	3	78692.24	0.46
		2	78691.78	−1.21
		1	78692.99	
3s² 3p³(⁴S°)7s	7s ⁵S°	2	79058.24	
3s² 3p³(⁴S°)5f	5f ⁵F	5 to 1	79143.18	
3s² 3p³(⁴S°)5f	5f ³F	4, 3, 2	79144.45	
3s² 3p³(⁴S°)7s	7s ³S°	1	79185.74	
3s² 3p³(²D°)4p	4p' ³P	2	79376.34	−29.40
		1	79405.74	−12.71
		0	79418.45	
3s² 3p³(⁴S°)7p	7p ⁵P	1		
		2		
		3	79785.72	
3s² 3p³(⁴S°)6d	6d ⁵D°	4	79992.36	
		3		
		2		
		1		
		0		

Config.	Desig.	J	Level	Interval
3s² 3p³(⁴S°)7p	7p ³P	2	80113.23	−7.28
		1	80120.51	−3.65
		0	80124.16	
3s² 3p³(⁴S°)6d	6d ³D°	3	80182.54	−1.39
		2	80183.93	−1.85
		1	80185.78	
2s² 3p³(⁴S°)8s	8s ⁵S°	2	80449.30	
3s² 3p³(⁴S°)6f	6f ⁵F	5 to 1	80494.73	
3s² 3p³(⁴S°)6f	6f ³F	4, 3, 2	80495.76	
3s² 3p³(⁴S°)8s	8s ³S°	1	80521.99	
3s² 3p³(⁴S°)7d	7d ⁵D°	4	80995.48	
		3		
		2		
		1		
		0		
3s² 3p³(⁴S°)8p	8p ³P	0, 1	80995.90	0.43
		2	80996.33	
3s² 3p³(⁴S°)7d	7d ³D°	3	81080.52	−2.31
		2	81082.83	−2.00
		1	81084.83	
3s² 3p³(⁴S°)9s	9s ⁵S°	2	81281.76	
3s² 3p³(⁴S°)7f	7f ⁵F	5 to 1	81309.23	
3s² 3p³(⁴S°)7f	7f ³F	4, 3, 2	81310.08	
3s² 3p³(⁴S°)9s	9s ³S°	1	[81327.3]	
3s² 3p³(⁴S°)8d	8d ⁵D°	4	81628.90	
		3		
		2		
		1		
		0		
3s² 3p³(⁴S°)8d	8d ³D°	3	81663.4	−3
		2	81666	−2
		1	81668	
3s² 3p³(⁴S°)10s	10s ⁵S°	2	81819.40	
3s² 3p³(⁴S°)8f	8f ⁵F	5 to 1	[81837.3]	
3s² 3p³(⁴S°)8f	8f ³F	4, 3, 2	[81837.9]	
3s² 3p³(⁴S°)9d	9d ⁵D°	4	82053.94	
		3		
		2		
		1		
		0		
3s² 3p³(⁴S°)10d	10d ⁵D°	4	82353.3	
		3		
		2		
		1		
		0		
S II (⁴S₁₁/₂)	Limit	---------	83559.3	

December 1947.

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms				
$3s^2\,3p^4$ $3s\,3p^5$	$\{$ $3p^4$ ^{1}S $3p^4$ ^{3}P $3p^4$ ^{1}D $3p^5$ ^{3}P°				

	$ns\ (n\geq 4)$		$np\ (n\geq 4)$		$nd\ (n\geq 3)$	$nf\ (n\geq 4)$
$3s^2\,3p^3(^4S°)nx$	$\{$ 4, 6–10s ^{5}S° 4– 8s ^{3}S°		4–7p ^{5}P 4–8p ^{3}P		3–10d ^{5}D° 3– 8d ^{3}D°	4–8f ^{5}F 5–7f ^{3}F
$3s^2\,3p^3(^2D°)nx'$	$\{$	4s′ ^{3}D° 4s′ ^{1}D°	4p′ ^{3}P 4p′ ^{3}D	4p′ ^{3}F 4p′ ^{1}F		
$3s^2\,3p^3(^2P°)nx''$	$\{$ 4s″ ^{3}P° 4s″ ^{1}P°					

*For predicted terms in the spectra of the S I isoelectronic sequence, see Introduction.

S II

(P I sequence; 15 electrons) $Z=16$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^3\ ^4S°_{1\frac12}$

$3p^3\ ^4S°_{1\frac12}$ *188824.5* cm^{-1} I. P. 23.4±0.1 volts

The terms are from the paper by Hunter.   He has revised and extended the earlier analyses of this spectrum.

The level labeled "x" in his list is here designated "1".   The configuration assignments for this level and for the term called "(^{2}P)" in the table are unknown.   The latter is attributed by Robinson to $3s^2\,3p^2$ (^{3}P) $3d$ instead of the term at 118146.50 cm^{-1}.

Intersystem combinations, connecting the doublet and quartet systems of terms, have been established by L. and E. Bloch and confirmed by Hunter.   They indicate a correction of $+317.17$ cm^{-1} to the absolute values of the doublet terms published by Ingram.

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<center>S II   S II</center>

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^3$	$3p^3\;^4S^\circ$	1½	0.0		$3s^2\,3p^2(^3P)4p$	$4p\;^2P^\circ$	½	133268.53	131.29
$3s^2\,3p^3$	$3p^3\;^2D^\circ$	1½	14851.9				1½	133399.82	
		2½	14883.4	31.5		1	½?	133359.4	
$3s^2\,3p^3$	$3p^3\;^2P^\circ$	½	24524.2			2 (^2P)	½	139845.6	170.1
		1½	24572.8	48.6		3	1½	140015.7	
$3s\,3p^4$	$3p^4\;^4P$	2½	79394.8	−363.1	$3s^2\,3p^2(^1D)4p$	$4p'\;^2F^\circ$	2½	140229.78	89.02
		1½	79757.9	−210.1			3½	140318.80	
		½	79968.0		$3s^2\,3p^2(^1D)4p$	$4p'\;^2D^\circ$	2½	140708.51	−41.49
$3s\,3p^4$	$3p^4\;^2P$	1½	105599.02	−445.14			1½	140750.00	
		½	106044.16		$3s^2\,3p^2(^1D)4p$	$4p'\;^2P^\circ$	½	143488.61	134.42
$3s^2\,3p^2(^3P)4s$	$4s\;^4P$	½	109560.50	270.78			1½	143623.03	
		1½	109831.28	437.05	$3s^2\,3p^2(^3P)5s$	$5s\;^4P$	½	150258.20	272.92
		2½	110268.33				1½	150531.12	465.15
$3s^2\,3p^2(^3P)3d$	$3d\;^4F$	1½	110176.83	136.30			2½	150996.27	
		2½	110313.13	195.35	$3s^2\,3p^2(^3P)5s$	$5s\;^2P$	½	151383.83	526.84
		3½	110508.48	257.83			1½	151910.67	
		4½	110766.31		$3s^2\,3p^2(^3P)4d$	$4d\;^4F$	1½	151959.41	134.93
$3s^2\,3p^2(^3P)4s$	$4s\;^2P$	½	112937.33	523.89			2½	152094.34	210.37
		1½	113461.22				3½	152304.71	310.54
$3s^2\,3p^2(^3P)3d$	$3d\;^4D$	½	114162.20	38.25			4½	152615.25	
		1½	114200.45	30.30	$3s^2\,3p^2(^3P)4d$	$4d\;^4D$	½	153153.66	48.06
		2½	114230.75	48.36			1½	153201.72	81.08
		3½	114279.11				2½	153282.80	130.72
$3s^2\,3p^2(^3P)3d$	$3d\;^2F$	2½	114804.11	481.20			3½	153413.52	
		3½	115285.31		$3s^2\,3p^2(^3P)4d$	$4d\;^4P$	2½	155818.37	−210.91
$3s^2\,3p^2(^3P)3d$	$3d\;^4P$	2½	115817.0	−53.4			1½	156029.28	−118.91
		1½	115870.4	−21.9			½	156148.19	
		½	115892.3		$3s^2\,3p^2(^3P)4d$	$4d\;^2F$	2½	156121.33	482.34
$3s^2\,3p^2(^3P)3d$	$3d\;^2P$	½					3½	156603.67	
		1½	118146.50		$3s^2\,3p^2(^3P)4d$	$4d\;^2D$	1½	158666.45	160.42
$3s^2\,3p^2(^3P)3d$	$3d\;^2D$	1½	119242.13	52.57			2½	158826.87	
		2½	119294.70		$3s^2\,3p^2(^3P)5p$	$5p\;^4D^\circ$	½	164118.6	133.4
$3s^2\,3p^2(^1D)4s$	$4s'\;^2D$	1½	121528.20	1.29			1½	164252.0	195.3
		2½	121529.49				2½	164447.3	325.4
$3s^2\,3p^2(^3P)4p$	$4p\;^2S^\circ$	½	125485.32				3½	164772.7	
$3s^2\,3p^2(^3P)4p$	$4p\;^4D^\circ$	½	127824.93	151.28	$3s^2\,3p^2(^1D)4d$	$4d'\;^2F$	3½	164180.63	−51.15
		1½	127976.21	256.86			2½	164231.78	
		2½	128233.07	366.04	$3s^2\,3p^2(^3P)5p$	$5p\;^4P^\circ$	½	164279.3	38.1
		3½	128599.11				1½	164317.4	142.1
$3s^2\,3p^2(^3P)4p$	$4p\;^4P^\circ$	½	129787.71	70.36			2½	164459.5	
		1½	129858.07	276.01	$3s^2\,3p^2(^1D)4d$	$4d'\;^2G$	4½	164334.94	−1.77
		2½	130134.08				3½	164336.71	
$3s^2\,3p^2(^3P)4p$	$4p\;^2D^\circ$	1½	130641.00	545.86	$3s^2\,3p^2(^3P)5p$	$5p\;^4S^\circ$	1½	165002.45	
		2½	131186.86						
$3s^2\,3p^2(^3P)4p$	$4p\;^4S^\circ$	1½	131028.76		S III $(^3P_0)$	*Limit*	---	188824.5	

October 1947.

S II Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2\,3p^3$	$\begin{cases}3p^3\ {}^4\text{S}°\\ \quad\quad 3p^3\ {}^2\text{P}° \quad 3p^3\ {}^2\text{D}°\end{cases}$		
$3s\ 3p^4$	$\begin{cases}\quad\quad 3p^4\ {}^4\text{P}\\ \quad\quad 3p^4\ {}^2\text{P}\end{cases}$		
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\,3p^2({}^3\text{P})nx$	$\begin{cases}4,5s\ {}^4\text{P}\\ 4,5s\ {}^2\text{P}\end{cases}$	$4,5p\ {}^4\text{S}°\quad 4,5p\ {}^4\text{P}°\quad 4,5p\ {}^4\text{D}°$ $4p\ {}^2\text{S}°\quad\ 4p\ {}^2\text{P}°\quad\ 4p\ {}^2\text{D}°$	$3,4d\ {}^4\text{P}\quad 3,4d\ {}^4\text{D}\quad 3,\ 4d\ {}^4\text{F}$ $3d\ {}^2\text{P}\quad 3,4d\ {}^2\text{D}\quad 3\ 4d\ {}^2\text{F}$
$3s^2\,3p^2({}^1\text{P})nx'$	$4s'\ {}^2\text{D}$	$4p'\ {}^2\text{P}°\quad\ 4p'\ {}^2\text{D}°\quad 4p'\ {}^2\text{F}°$	$4d'\ {}^2\text{F}\quad 4d'\ {}^2\text{G}$

*For predicted terms in the spectra of the P I isoelectronic sequence, see Introduction.

S III

(Si I sequence; 14 electrons) $\qquad\qquad\qquad\qquad\qquad Z=16$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^2\ {}^3\text{P}_0$

$3p^2\ {}^3\text{P}_0$ 282752 cm^{-1} $\qquad\qquad\qquad$ I. P. 35.0$\pm$0.4 volts

The present term list has been compiled from those published by Hunter and by Robinson, although Ingram, Gilles, and others have contributed to the analysis.

Intersystem combinations connecting the singlet and triplet terms have been observed. Robinson derives from his measures a correction of -6 cm^{-1} to be applied to all terms higher than 140000 cm^{-1}. This correction has been introduced here. An estimated value of the interval of $3p^3\ {}^3\text{P}°_{1,0}$ is entered in brackets in the table.

The quintet terms suggested by Gilles have been omitted, awaiting further confirmation.

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S III   S III

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^2$	$3p^2\ ^3P$	0	0.0	297.2	$3s^2\,3p(^2P°)3d$	$3d\ ^3D°$	1	147550.32	140.67
		1	297.2	535.3			2	147690.99	53.55
		2	832.5				3	147744.54	
$3s^2\,3p^2$	$3p^2\ ^1D$	2	11320		$3s^2\,3p(^2P°)4s$	$4s\ ^1P°$	1	148397.8	
$3s^2\,3p^2$	$3p^2\ ^1S$	0	27163		$3s^2\,3p(^2P°)4p$	$4p\ ^3D$	1	169770.04	297.27
$3s\ 3p^3$	$3p^3\ ^3D°$	1	84018.9	27.5			2	170067.31	581.63
		2	84046.4	53.1			3	170648.94	
		3	84099.5		$3s^2\,3p(^2P°)4p$	$4p\ ^3P$	0	172631.27	154.50
$3s\ 3p°$	$3p^3\ ^3P°$	2	98743.0	−22.6			1	172785.77	405.96
		1	98765.6	[−6]			2	173191.73	
		0			$3s^2\,3p(^2P°)4p$	$4p\ ^3S$	1	174036.19	
$3s\ 3p^3$	$3p^3\ ^1D°$	2	104159?		$3s^2\,3p(^2P°)4d$	$4d\ ^3F°$	2	204578.89	491.86
$3s\ 3p^3$	$3p^3\ ^1P°$	1	136839				3	205070.75	489.92
$3s\ 3p^3$	$3p^3\ ^3S°$	1	138061.4				4	205560.67	
$3s^2\,3p(^2P°)3d$	$3d\ ^3P°$	0	143095.91	20.28	$3s^2\,3p(^2P°)4d$	$4d\ ^3D°$	1	206538.87	132.74
		1	143116.19	7.74			2	206671.61	239.36
		2	143123.93				3	206910.97	
$3s^2\,3p(^2P°)4s$	$4s\ ^3P°$	0	146696.19	40.35	$3s^2\,3p(^2P°)5s$	$5s\ ^3P°$	0	209773.4	152.7
		1	146736.54	409.46			1	209926.1	771.5
		2	147146.00				2	210697.6	
					$3s^2\,3p(^2P°)5s$	$5s\ ^1P°$	1	211326.8	
					S IV $(^2P°_{1/2})$	**Limit**	- - - - - - - - -	**282752**	

October 1947.

S III Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms			
$3s^2\,3p^2$	$\{$ $3p^2\ ^3P$ $3p^2\ ^1D$ $3p^2\ ^1S$			
$3s\ 3p^3$	$\{$ $3p^3\ ^3S°$ $3p^3\ ^3P°$ $3p^3\ ^3D°$ $3p^3\ ^1P°$ $3p^3\ ^1D°$			

	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\,3p(^2P°)nx$	$\{$ $4,5s\ ^3P°$ $4,5s\ ^1P°$	$4p\ ^3S$ $4p\ ^3P$ $4p\ ^3D$	$3d\ ^3P°$ $3,4d\ ^3D°$ $4d\ ^3F°$

*For predicted terms in the spectra of the Si I isoelectronic sequence, see Introduction.

S IV

(Al I sequence; 13 electrons) $Z=16$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\ ^2\mathrm{P}^{\circ}_{1/2}$

$3p\ ^2\mathrm{P}^{\circ}_{1/2}\ \boldsymbol{381541.4}$ cm^{-1} I. P. 47.29 volts

This spectrum is incompletely analyzed but 53 lines have been classified in the range from 519 A to 3118 A.   For the doublet terms the authors' notation is entered in the first column of the table.   The configurations are as given in Bacher and Goudsmit.

The quartet terms are from Bowen's 1932 paper.   No intersystem combinations have been observed, as indicated by the uncertainty x.   Bowen remarks that the relative positions of the doublet and quartet terms are only approximately determined, by assuming that the difference between the terms $4s\ ^2\mathrm{S}$ and $4s\ ^4\mathrm{P}^{\circ}$ is equal to that between the terms $3s^2\ ^1\mathrm{S}$ and $3p\ ^3\mathrm{P}^{\circ}$ in S v.

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S IV

Authors	Config.	Desig.	J	Level	Interval	Authors	Config.	Desig.	J	Level	Interval
$3p_2$ $3p_1$	$3s^2(^1\mathrm{S})3p$	$3p\ ^2\mathrm{P}^{\circ}$	½ 1½	0. 0 950. 2	950. 2	$4p_2$ $4p_1$	$3s^2(^1\mathrm{S})4p$	$4p\ ^2\mathrm{P}^{\circ}$	½ 1½	213507. 4 213717. 4	210. 0
	$3s\,3p^2$	$3p^2\ ^4\mathrm{P}$	½ 1½ 2½	71840 $+x$ 72184 $+x$ 72731 $+x$	344 547		$3s\,3p(^3\mathrm{P}^{\circ})3d$	$3d\ ^4\mathrm{P}^{\circ}$	2½ 1½ ½	222854 $+x$ 223143 $+x$	-289
bD_2 bD_3	$3s\,3p^2$	$3p^2\ ^2\mathrm{D}$	1½ 2½	94101. 9 94148. 1	46. 2		$3s\,3p(^3\mathrm{P}^{\circ})3d$	$3d\ ^4\mathrm{D}^{\circ}$	½ 1½ 2½ 3½	224991 $+x$ 225094 $+x$ 225194 $+x$ 225274 $+x$	103 100 80
bS	$3s\,3p^2$	$3p^2\ ^2\mathrm{S}$	½	123503. 9							
bP_1 bP_2	$3s\,3p^2$	$3p^2\ ^2\mathrm{P}$	½ 1½	133617. 9 134243. 9	626. 0	$4d$	$3s^2(^1\mathrm{S})4d$	$4d\ ^2\mathrm{D}$	{ 1½ 2½	}255389. 8	
$3d_2$ $3d_1$	$3s^2(^1\mathrm{S})3d$	$3d\ ^2\mathrm{D}$	1½ 2½	152127. 1 152141. 4	14. 3		$3s\,3p(^3\mathrm{P}^{\circ})4s$	$4s\ ^4\mathrm{P}^{\circ}$	½ 1½ 2½	263759 $+x$ 264105 $+x$ 264741 $+x$	346 636
$4s$	$3s^2(^1\mathrm{S})4s$	$4s\ ^2\mathrm{S}$	½	181432. 2		$5s$	$3s^2(^1\mathrm{S})5s$	$5s\ ^2\mathrm{S}$	½	271010. 4	
	$3p^3$	$3p^3\ ^4\mathrm{S}^{\circ}$	1½	197110 $+x$							
cP	$3p^3$	$3p^3\ ^2\mathrm{P}^{\circ}$	{ 1½ ½	}211368			S v ($^1\mathrm{S}_0$)	*Limit*	------	381541. 4	

September 1947.

S IV Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms			
$3s^2(^1S)3p$		$3p\ ^2P°$		
$3s\ \ 3p^2$	$3p^2\ ^2S$	$3p^2\ ^4P$ $3p^2\ ^2P$	$3p^2\ ^2D$	
$3p^3$	$3p^3\ ^4S°$	$3p^3\ ^2P°$		

	$ns\ (n\geq 4)$	$np\,(n\geq 4)$	$nd\ (n\geq 3)$	
$3s^2(^1S)nx$	$4, 5s\ \ ^2S$	$4p\ ^2P°$		$3, 4d\ ^2D$
$3s\ \ 3p(^3P°)nx$	$4s\ \ ^4P°$		$3d\ ^4P°$	$3d\ ^4D°$

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

S V

(Mg I sequence; 12 electrons) $\hspace{4cm}$ $Z=16$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\ ^1S_0$

$3s^2\ ^1S_0$ **584700 cm⁻¹** $\hspace{4cm}$ I. P. 72.5± volts

This spectrum is incompletely analyzed, but Bowen has classified 30 lines in the range between 437 A and 905 A. He gives absolute values for only the triplet terms, but lists the singlet combination $3s^2\ ^1S_0 - 3p\ ^1P_1°$, which has been used to calculate $3p\ ^1P_1°$ in the table.

By extrapolation along the isoelectronic sequence the writer has estimated the limit $3s^2\ ^1S_0$ as approximately 584700 cm⁻¹, which places $3p\ ^3P_0°$ at 83071 cm⁻¹ above the ground state zero. These estimated values are entered in brackets in the table. The uncertainty, x, may be several hundred cm⁻¹. Bowen has estimated the error of the limit as probably not greater than ±1000 cm⁻¹.

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S V $\hspace{12cm}$ S V

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ ^1S$	0	0		$3s(^2S)4s$	$4s\ ^3S$	1	$311670\ +x$	
$3s\,(^2S)3p$	$3p\ ^3P°$	0 1 2	$[83071]+x$ $83433\ +x$ $84200\ +x$	362 767	$3p(^2P°)3d$	$3d\ ^3P°$	2 1 0	$345376\ +x$ $345750\ +x$ $345987\ +x$	−374 −237
$3s\,(^2S)3p$	$3p\ ^1P°$	1	127149		$3p(^2P°)3d$	$3d\ ^3D°$	1 2 3	$347883\ +x$ $348051\ +x$ $348168\ +x$	168 117
$3p^2$	$3p^2\ ^3P$	0 1 2	$200000\ +x$ $200417\ +x$ $201186\ +x$	417 769					
$3s\,(^2S)3d$	$3d\ ^3D$	1, 2, 3	$234987\ +x$		S VI $(^2S_{1/2})$	**Limit**	--------	[584700]	

September 1947.

S v Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms	
$3s^2$	$3s^2\ {}^1S$	
$3s({}^2S)3p$	$\{$	$3p\ {}^3P^o$ $3p\ {}^1P^o$
$3p^2$	$3p^2\ {}^3P$	
	$ns\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s({}^2S)nx$	$4s\ {}^3S$	$3d\ {}^3D$
$3p({}^2P^o)nx$		$3d\ {}^3P^o\qquad 3d\ {}^3D^o$

*For predicted terms in the spectra of the Mg I
isoelectronic sequence, see Introduction.

S VI

(Na I sequence; 11 electrons) $Z=16$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s\ {}^2S_{1/2}$

$3s\ {}^2S_{1/2}$ **710194** cm^{-1} I. P. 88.029±0.003 volts

The terms are from Robinson, who has extended the earlier analysis by Bowen and Millikan.
There are 29 classified lines, all but 2 of which are in the region between 171 A and 1117A.
The absolute value of the ground state was extrapolated along the isoelectronic sequence.

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S VI

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s$	$3s\ {}^2S$	$\frac{1}{2}$	0		$5f$	$5f\ {}^2F^o$	$\{\begin{matrix}2\frac{1}{2}\\3\frac{1}{2}\end{matrix}\}$	551848	
$3p$	$3p\ {}^2P^o$	$\frac{1}{2}$ $1\frac{1}{2}$	105874 107137	1263	$5g$	$5g\ {}^2G$	$\{\begin{matrix}3\frac{1}{2}\\4\frac{1}{2}\end{matrix}\}$	552106	
$3d$	$3d\ {}^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	247420 247452	32	$6s$	$6s\ {}^2S$	$\frac{1}{2}$	573823	
$4s$	$4s\ {}^2S$	$\frac{1}{2}$	362983		$6p$	$6p\ {}^2P^o$	$\frac{1}{2}$ $1\frac{1}{2}$	583679	
$4p$	$4p\ {}^2P^o$	$\frac{1}{2}$ $1\frac{1}{2}$	401164 401621	457	$6d$	$6d\ {}^2D$	$\{\begin{matrix}1\frac{1}{2}\\2\frac{1}{2}\end{matrix}\}$	596877	
$4d$	$4d\ {}^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	451785 451808	23	$6f$	$6f\ {}^2F^o$	$\{\begin{matrix}2\frac{1}{2}\\3\frac{1}{2}\end{matrix}\}$	600170	
$4f$	$4f\ {}^2F^o$	$\{\begin{matrix}2\frac{1}{2}\\3\frac{1}{2}\end{matrix}\}$	462653		$7d$	$7d\ {}^2D$	$\{\begin{matrix}1\frac{1}{2}\\2\frac{1}{2}\end{matrix}\}$	627231	
$5s$	$5s\ {}^2S$	$\frac{1}{2}$	504112		$7f$	$7f\ {}^2F^o$	$\{\begin{matrix}2\frac{1}{2}\\3\frac{1}{2}\end{matrix}\}$	629395	
$5p$	$5p\ {}^2P^o$	$\frac{1}{2}$ $1\frac{1}{2}$	522030 522248	218	S VII (${}^1S_0$)	Limit	————	710194	
$5d$	$5d\ {}^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	546021 546032	11					

June 1947.

S VII

(Ne I sequence; 10 electrons) $Z=16$

Ground state $1s^2\, 2s^2\, 2p^6\, {}^1S_0$

$2p^6\, {}^1S_0$ **2266990** cm^{-1} I. P. 280.99 volts

Ferner has classified 16 lines between 46 A and 72 A as combinations with the ground term, and generously furnished his analysis in advance of publication. The term designations he assigns on the assumption of LS-coupling are given in the table under the heading "Author."

As for Ne I, the jl-coupling notation in the general form suggested by Racah is introduced. Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

G. Racah, Phys. Rev. **61**, 537 (L) (1942).
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 62 (1948).   (I P) (T) (C L)

S VII   **S VII**

Author	Config.	Desig.	J	Level	Author	Config.	Desig.	J	Level
$2p\ {}^1S_0$	$2p^6$	$2p^6\ {}^1S$	0	0		$2p^5({}^2P^\circ_{1\frac12})5s$	$5s\ [1\frac12]^\circ$	2	
					$5s\ {}^3P_1$			1	1998920
	$2p^5({}^2P^\circ_{1\frac12})3s$	$3s\ [1\frac12]^\circ$	2						
$3s\ {}^3P_1$			1	1376220					
	$2p^5({}^2P^\circ_{\frac12})3s$	$3s'\ [\frac12]^\circ$	0		$3p'\left\{{}^3P_1 \atop {}^1P_1\right\}$	$2s\ 2p^6({}^2S)3p$	$3p\ \left\{{}^3P^\circ \atop {}^1P^\circ\right\}$	1	2000400
$3s\ {}^1P_1$			1	1388330					
	$2p^5({}^2P^\circ_{1\frac12})3d$	$3d\ [\frac12]^\circ$	0		$5d\ {}^1P_1$	$2p^5(P^\circ_{1\frac12})5d$	$5d\ [1\frac12]^\circ$	1	2046080
$3d\ {}^3P_1$			1	1624770	$5d\ {}^3D_1$	$2p^5({}^2P^\circ_{\frac12})5d$	$5d'\ [1\frac12]^\circ$	1	2055630
$3d\ {}^1P_1$	`"`	$3d\ [1\frac12]^\circ$	1	1644630					
$3d\ {}^3D_1$	$2p^5({}^2P^\circ_{\frac12})3d$	$3d'\ [1\frac12]^\circ$	1	1662210	$6d\ {}^1P_1$	$2p^5({}^2P^\circ_{1\frac12})6d$	$6d\ [1\frac12]^\circ$	1	2113850
					$6d\ {}^3D_1$	$2p^5({}^2P^\circ_{\frac12})6d$	$6d'\ [1\frac12]^\circ$	1	2123230
	$2p^5({}^2P^\circ_{1\frac12})4s$	$4s\ [1\frac12]^\circ$	2						
$4s\ {}^3P_1$			1	1820230	$7d\ {}^3D_1$	$2p^5({}^2P^\circ_{\frac12})7d$	$7d'\ [1\frac12]^\circ$	1	2163940
	$2p^5({}^2P^\circ_{\frac12})4s$	$4s'\ [\frac12]^\circ$	0						
$4s\ {}^1P_1$			1	1829760	S VIII $({}^2P^\circ_{1\frac12})$		Limit	-------	2266990
$4d\ {}^1P_1$	$2p^5({}^2P^\circ_{1\frac12})4d$	$4d\ [1\frac12]^\circ$	1	1919500	S VIII $({}^2P_{\frac12})$		Limit	-------	2277120
$4d\ {}^3D_1$	$2p^5({}^2P^\circ_{\frac12})4d$	$4d'\ [1\frac12]^\circ$	1	1930240					

August 1947.

S VII OBSERVED LEVELS*

Config. $1s^2\,2s^2+$	Observed Terms		
$2p^6$	$2p^6\ {}^1S$		
	ns $(n \geq 3)$	nd $(n \geq 3)$	np $(n \geq 3)$
$2p^5(^2P°)nx$	$\Big\{$ $\begin{matrix}3\text{–}5s\ {}^3P°\\ 3\text{–}4s\ {}^1P°\end{matrix}$	$\begin{matrix}3d\ {}^3P°\quad 3\text{–}7d\ {}^3D°\\ 3\text{–}6d\ {}^1P°\end{matrix}$	
$2p^5(^2S)nx$			$3p\Big\{\begin{matrix}{}^3P°\\ {}^1P°\end{matrix}$

jl-Coupling Notation

	Observed Pairs		
	ns $(n \geq 3)$	nd $(n \geq 3)$	
$2p^5(^2P°_{1½})nx$	$3\text{–}5s\ [1½]°$	$\begin{matrix}3d\ [\ ½]°\\ 3\text{–}6d\ [1½]°\end{matrix}$	
$2p^5(^2P°_{½})nx'$	$3\text{–}4s'\ [\ ½]°$	$3\text{–}7d'\ [1½]°$	

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

S VIII

(F I sequence; 9 electrons) $Z=16$

Ground state $1s^2\,2s^2\,2p^5\ {}^2P°_{1½}$

$2p^5\ {}^2P°_{1½}$ **2652720** cm^{-1} I. P. 328.80 volts

The analysis was furnished by Ferner in advance of publication. He has classified 44 lines in the interval between 44 A and 65 A. All but one of the observed combinations are with the ground term. In addition, Robinson has classified a pair of lines at 202.605 A and 198.550 A as $2p^5\ {}^2P°-2p^6\ {}^2S$.

Ferner's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

H. A. Robinson, Phys. Rev. **52**, 724 (1937). (C L)
E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A**, No. 1, p. 57 (1948). (I P) (T) (C L)

S VIII

Author	Config.	Desig.	J	Level	Interval
2p ²P₂ / ²P₁	2s² 2p⁵	2p⁵ ²P°	1½ / ½	0 / *10130*	−10130
2p' ²S₁	2s 2p⁶	2p⁶ ²S	½	503590	
3s ⁴P₃ / ⁴P₂ / ⁴P₁	2s² 2p⁴(³P)3s	3s ⁴P	2½ / 1½ / ½	1559580 / 1565250 / 1569290	−5670 / −4040
3s ²P₂ / ²P₁	2s² 2p⁴(³P)3s	3s ²P	1½ / ½	1579700 / 1586650	−6950
3̄s ²D₃ / ²D₂	2s² 2p⁴(¹D)3s	3s' ²D	2½ / 1½	1623380 / 1623610	−230
3̿s ²S₁	2s² 2p⁴(¹S)3s	3s'' ²S	½	1688170	
3d ⁴D₃	2s² 2p⁴(³P)3d	3d ⁴D	3½ / 2½ / 1½ / ½	1831370 / 1822510	
3d ⁴P₂ / ⁴P₃	2s² 2p⁴(³P)3d	3d ⁴P	½ / 1½ / 2½	1834830 / 1838740	3910
3d ²P₁ / ²P₂	2s² 2p⁴(³P)3d	3d ²P	½ / 1½	1839250 / 1847550	8300
3d ²D₂ / ²D₃	2s² 2p⁴(³P)3d	3d ²D	1½ / 2½	1842770 / 1847810	5040
3̄d ²P₁ / ²P₂	2s² 2p⁴(¹D)3d	3d' ²P	½ / 1½	1888460 / 1897460	9000
3̄d ²D₃ / ²D₂	2s² 2p⁴(¹D)3d	3d' ²D	2½ / 1½	1892000 / 1898220	−6220

S VIII

Author	Config.	Desig.	J	Level	Interval
3̄d ²S₁	2s² 2p⁴(¹D)3d	3d' ²S	½	1894330	
3̄d ²F₃	2s² 2p⁴(¹D)3d	3d' ²F	3½ / 2½	1895520	
3̿d ²D₃ / ²D₂	2s² 2p⁴(¹S)3d	3d'' ²D	2½ / 1½	1952100 / 1953010	−910
3s' ²P₂ / ²P₁	2s 2p⁵(³P°)3s	3s''' ²P°	1½ / ½	*2038530* / *2045040*	−6510
4s ²P₂ / ²P₁	2s² 2p⁴(³P)4s	4s ²P	1½ / ½	2102340 / 2111240	−8900
4d ⁴P₃	2s² 2p⁴(³P)4d	4d ⁴P	½ / 1½ / 2½	2199830	
4d ²D₂ / ²D₃	2s² 2p⁴(³P)4d	4d ²D	1½ / 2½	2204100 / 2208530	4430
4d ²P₂	2s² 2p⁴(³P)4d	4d ²P	½ / 1½	2207770	
4̄d ²S₁	2s² 2p⁴(¹D)4d	4d' ²S	½	2253570	
4̄d ²F₃	2s² 2p⁴(¹D)4d	4d' ²F	3½ / 2½	2254790	
	S IX (³P₂)	Limit	-----	*2652720*	

August 1947.

S VIII Observed Terms*

Config. 1s²+	Observed Terms				
2s² 2p⁵	2p⁵ ²P°				
2s 2p⁶	2p⁶ ²S				
	ns (n≥3)		nd (n≥3)		
2s² 2p⁴(³P)nx	{ 3s ⁴P / 3,4s ²P		3,4d ⁴P 3d ⁴D / 3,4d ²P 3,4d ²D		
2s² 2p⁴(¹D)nx'		3s¹ ²D	3,4d' ²S 3d' ²P 3d' ²D 3,4d' ²F		
2s² 2p⁴(¹S)nx''	3s'' ²S		3d'' ²D		
2s 2p⁵(³P°)nx'''		3s''' ²P°			

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

S IX

(O I sequence; 8 electrons) $Z=16$

Ground state $1s^2\, 2s^2\, 2p^4\, {}^3P_2$

$2p^4\, {}^3P_2$ 3057300 cm^{-1}

I. P. 378.95 volts

Ferner has found 17 terms and classified 21 lines in this spectrum in the range from 46 A to 56 A. No intersystem combinations have been observed and the uncertainty, x, may be large. The unit adopted by Ferner, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 48 (1948). (I P) (T) (C L)

S IX

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$2s^2\, 2p^4$	$2p^4$ ^3P	2	0	-7970	$2s^2\, 2p^3(^2D°)3d$	$3d'$ $^1D°$	2	$2117140+x$	
		1	7970	-2660	$2s^2\, 2p^3(^2D°)3d$	$3d'$ $^3S°$	1	2125310	
		0	10630		$2s^2\, 2p^3(^2D°)3d$	$3d'$ $^1F°$	3	$2134410+x$	
$2s^2\, 2p^4$	$2p^4$ ^1D	2	$58000+x$		$2s^2\, 2p^3(^2P°)3d$	$3d''$ $^3P°$	0		
$2s^2\, 2p^4$	$2p^4$ ^1S	0	$122300+x$				1	2144820	
$2s^2\, 2p^3(^4S°)3s$	$3s$ $^3S°$	1	1783150				2	2146610	1790
$2s^2\, 2p^3(^2D°)3s$	$3s'$ $^3D°$	3	1845770		$2s^2\, 2p^3(^2P°)3d$	$3d''$ $^3F°$	4		
		2	1846340	-570			3		
		1					2	2154570	
$2s^2\, 2p^3(^2D°)3s$	$3s'$ $^1D°$	2	$1858500+x$		$2s^2\, 2p^3(^2P°)3d$	$3d''$ $^3D°$	3	2156430	
$2s^2\, 2p^3(^2P°)3s$	$3s''$ $^1P°$	1	$1904040+x$				2		
$2s^2\, 2p^3(^4S°)3d$	$3d$ $^3D°$	1, 2	2035220				1		
		3	2035870	650	$2s^2\, 2p^3(^2P°)3d$	$3d''$ $^1P°$	1	$2162470+x$	
$2s^2\, 2p^3(^2D°)3d$	$3d'$ $^3D°$	3, 2, 1	2108190						
$2s^2\, 2p^3(^2D°)3d$	$3d'$ $^3P°$	2	2116450		S x ($^4S^°_{1\frac12}$)	Limit	--------	3057300	
		1	2119180	-2730					
		0							

August 1947.

S IX Observed Terms*

Config. $1s^2+$	Observed Terms					
		$2p^4$ ^3P				
$2s^2\, 2p^4$	$\{\,2p^4$ ^1S		$2p^4$ ^1D			
	ns ($n\geq 3$)			*nd* ($n\geq 3$)		
$2s^2\, 2p^3(^4S°)nx$	$3s$ $^3S°$				$3d$ $^2D°$	
$2s^2\, 2p^3(^2D°)nx'$	$\{$	$3s'$ $^3D°$	$3d'$ $^3S°$	$3d'$ $^3P°$	$3d'$ $^3D°$	
		$3s'$ $^1D°$			$3d'$ $^1D°$	$3d'$ $^1F°$
$2s^2\, 2p^3(^2P°)nx''$	$\{$			$3d''$ $^3P°$	$3d''$ $^3D°$	$3d''$ $^3F°$
	$3s''$ $^1P°$			$3d''$ $^1P°$		

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

S x

$Z=16$

Ground state $1s^2\,2s^2\,2p^3\,{}^4S^{\circ}_{1\frac{1}{2}}$

$2p^3\,{}^4S^{\circ}_{1\frac{1}{2}}\,\textbf{3615900}$ cm^{-1} I. P. 448.2 volts

The spectrum is very incompletely analyzed. Ferner has classified 4 lines between 44 A and 47 A and has generously furnished these classifications in advance of publication. The terms in the table have been derived from Ferner's data, adjusted by Robinson to fit the isoelectronic sequence data. All entries in brackets have been extrapolated along the isoelectronic sequence by Robinson. No intersystem combinations have been observed and the uncertainty, x, probably exceeds ±1000 cm^{-1}.

Ferner's unit, 10^3 cm^{-1}, has been changed to cm^{-1} in deriving the term values.

<div align="center">REFERENCES</div>

E. Ferner, Ark. Mat. Astr. Fys. (Stockholm) **36A,** No. 1, p. 42 (1948). (C L)
H. A. Robinson, unpublished material (March 1948). (I P) (T)

<div align="center">S x</div>

Config.	Desig.	J	Level	Interval
$2s^2\,2p^3$	$2p^3\,{}^4S^{\circ}$	$1\frac{1}{2}$	_0_	
$2s^2\,2p^3$	$2p^3\,{}^2P^{\circ}$	$\frac{1}{2}$	_[122230]+x_	[1500]
		$1\frac{1}{2}$	_[123730]+x_	
$2s^2\,2p^2({}^3P)3s$	$3s\;{}^4P$	$\frac{1}{2}$		
		$1\frac{1}{2}$	2092360	6100
		$2\frac{1}{2}$	2098460	
$2s^2\,2p^2({}^3P)3d$	$3d\;{}^2D$	$1\frac{1}{2}$	2375140 +x	2160
		$2\frac{1}{2}$	2377300 +x	
S XI $({}^3P_0)$	_Limit_	---	_[3615900]_	

March 1948.

S XII

$Z=16$

Ground state $1s^2\,2s^2\,2p\,{}^2P^{\circ}_{\frac{1}{2}}$

$2p\,{}^2P^{\circ}_{\frac{1}{2}}$ cm^{-1} I. P.   volts

By extrapolation along the B I isoelectronic sequence, Edlén estimates that the separation of the lowest term, $2p\,{}^2P^{\circ}_{\frac{1}{2}}-2p\,{}^2P^{\circ}_{1\frac{1}{2}}$, is 13266 cm^{-1} (7536 A).

<div align="center">REFERENCE</div>

B. Edlén, Zeit. Astroph. **22,** 58 (1942). (T)

July 1948.

CHLORINE

Cl I

17 electrons $Z=17$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^5\,{}^2\mathrm{P}^{\circ}_{1\frac{1}{2}}$

$3p^5\,{}^2\mathrm{P}^{\circ}_{1\frac{1}{2}}$ *104991* cm^{-1} I. P. 13.01 volts

Most of the terms are from the analysis by Kiess, who has revised and extended the earlier work on this spectrum.   Green and Lynn have observed the Zeeman effect and, with the aid of *g*-values, added a few terms to the list by Kiess.   They list 11 unclassified lines for which both *g*-values are known.

Their miscellaneous levels are labeled in the table with numbers assigned by the writer, followed by their tentative designations entered in parentheses.

Intersystem combinations, connecting the doublet and quartet terms, have been observed

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L. A. Turner, Phys. Rev. **27**, 401 (1926).   (C L)
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C. C. Kiess, Bur. Std. J. Research **10**, 827, RP570 (1933).   (I P) (T) (C L)
B. Edlén, Zeit, Phys. **104**, 413 (1937).   (I P) (C L)
W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946).   (Summary hfs)
J. B. Green and J. T. Lynn, Phys. Rev. **69**, 165 (1946).   (T) (C L) (Z E)
L. Davis, Jr., B. T. Feld, C. W. Zabel, and J. R. Zacharias, Phys. Rev. **73**, 525 (L) (1948).   (hfs)

Cl I

Config.	Desig.	J	Level	Interval	Obs. g	Config.	Desig.	J	Level	Interval	Obs. g
$3s^2\,3p^5$	$3p^5\,{}^2\mathrm{P}^{\circ}$	$1\frac{1}{2}$	*0*	-881		$3s^2\,3p^4({}^3\mathrm{P})4p$	$4p\,{}^2\mathrm{S}^{\circ}$	$\frac{1}{2}$	*85239. 98*		1. 280
		$\frac{1}{2}$	*881*			$3s^2\,3p^4({}^3\mathrm{P})4p$	$4p\,{}^2\mathrm{P}^{\circ}$	$1\frac{1}{2}$	*85438. 04*	$-475. 40$	1. 327
$3s^2\,3p^4({}^3\mathrm{P})4s$	$4s\,{}^4\mathrm{P}$	$2\frac{1}{2}$	*71954. 00*	$-530. 20$	1. 599			$\frac{1}{2}$	*85913. 44*		1. 379
		$1\frac{1}{2}$	*72484. 20*	$-338. 44$	1. 722	$3s^2\,3p^4({}^3\mathrm{P})4p$	$4p\,{}^4\mathrm{S}^{\circ}$	$1\frac{1}{2}$	*85730. 68*		1. 877
		$\frac{1}{2}$	*72822. 64*		2. 652						
$3s^2\,3p^4({}^3\mathrm{P})4s$	$4s\,{}^2\mathrm{P}$	$1\frac{1}{2}$	*74221. 44*	$-639. 80$	1. 340	$3s^2\,3p^4({}^1\mathrm{D})4p$	$4p'\,{}^2\mathrm{P}^{\circ}$	$1\frac{1}{2}$	*94309. 67*	$-154. 83$	1. 328
		$\frac{1}{2}$	*74861. 24*		0. 663			$\frac{1}{2}$	*94464. 50*		0. 872
$3s^2\,3p^4({}^3\mathrm{P})4p$	$4p\,{}^4\mathrm{P}^{\circ}$	$2\frac{1}{2}$	*82914. 54*	$-212. 05$	1. 591	$3s^2\,3p^4({}^3\mathrm{P})5p$	$5p\,{}^4\mathrm{P}^{\circ}$	$2\frac{1}{2}$	*94477. 93*	$-181. 35$	1. 559
		$1\frac{1}{2}$	*83126. 59*	$-233. 96$	1. 723			$1\frac{1}{2}$	*94659. 28*	$-310. 15$	1. 722
		$\frac{1}{2}$	*83360. 55*		2. 617			$\frac{1}{2}$	*94969. 43*		2. 309
$3s^2\,3p^4({}^3\mathrm{P})4p$	$4p\,{}^4\mathrm{D}^{\circ}$	$3\frac{1}{2}$	*83889. 64*	$-238. 26$	1. 422	$3s^2\,3p^4({}^3\mathrm{P})5p$	$5p\,{}^4\mathrm{D}^{\circ}$	$3\frac{1}{2}$	*94727. 91*	$-94. 84$	1. 420
		$2\frac{1}{2}$	*84127. 90*	$-353. 01$	1. 308			$2\frac{1}{2}$	*94822. 75*	$-486. 68$	1. 247
		$1\frac{1}{2}$	*84480. 91*	$-203. 36$	1. 163			$1\frac{1}{2}$	*95309. 43*	$-221. 08$	1. 147
		$\frac{1}{2}$	*84684. 27*		0. 059			$\frac{1}{2}$	*95530. 51*		1. 409
$3s^2\,3p^4({}^1\mathrm{D})4s$	$4s'\,{}^2\mathrm{D}$	$2\frac{1}{2}$	*84115. 68*	$-1. 70$		$3s^2\,3p^4({}^1\mathrm{D})4p$	$4p'\,{}^2\mathrm{F}^{\circ}$	$2\frac{1}{2}$	*95140. 05*	35. 95	
		$1\frac{1}{2}$	*84117. 38*					$3\frac{1}{2}$	*95176. 00*		
$3s^2\,3p^4({}^3\mathrm{P})4p$	$4p\,{}^2\mathrm{D}^{\circ}$	$2\frac{1}{2}$	*84643. 69*	$-340. 35$	1. 269	$3s^2\,3p^4({}^3\mathrm{P})5p$	$5p\,{}^2\mathrm{D}^{\circ}$	$2\frac{1}{2}$	*95396. 31*	$-305. 70$	1. 352
		$1\frac{1}{2}$	*84984. 04*		0. 986			$1\frac{1}{2}$	*95702. 01*		1. 321

Cl I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3s^2\,3p^4(^3P)5p$	$5p\ ^2S°$	½	95593.28		0.699
$3s^2\,3p^4(^3P)5p$	$5p\ ^4S°$	1½	95608.30		1.531
$3s^2\,3p^4(^3P)4d$	$4d\ ^4D$	3½	95696.49	−85.92	1.367
		2½	95782.41	−110.75	1.209
		1½	95893.16	−98.02	0.00
		½	95991.18		
$3s^2\,3p^4(^3P)5p$	$5p\ ^2P°$	1½	96308.84	−280.80	1.286
		½	96589.64		0.712
$3s^2\,3p^4(^1D)4p$	$4p'\ ^2D°$	2½	96478.38	−3.32	0.867
		1½	96481.70		
$3s^2\,3p^4(^3P)4d$	$4d\ ^4F$	4½	96490.40	−236.41	
		3½	96726.81	−214.49	
		2½	96941.30	−314.25	1.097
		1½	97255.55		0.967
$3s^2\,3p^4(^3P)4d$	$4d\ ^2F$	3½	96829.85	−350.09	
		2½	97179.94		
$3s^2\,3p^4(^3P)6s$	$6s\ ^4P$	2½	97233.37	−242.83	1.500
		1½	97476.20	−619.76	1.393
		½	98095.96		1.962
$3s^2\,3p^4(^3P)4d$	$4d\ ^4P$	2½	97334.60	−706.20	1.241
		1½	98040.80	−600.42	1.620
		½	98641.22		
$3s^2\,3p^4(^3P)4d$	$4d\ ^2D$	2½	97529.85	−273.61	1.355
		1½	97803.46		
$3s^2\,3p^4(^3P)6p$	$6p\ ^4P°$	2½			
		1½			
		½	98911.6		1.91
$3s^2\,3p^4(^3P)6p$	$6p\ ^4D°$	3½			
		2½			
		1½	99015.1		1.32
		½			
$3s^2\,3p^4(^3P)5d$	$5d\ ^4D$	3½	99196.02	−68.69	1.392
		2½	99264.71	−85.51	1.358
		1½	99350.22	−53.39	
		½	99403.61		0.363

Cl I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3s^2\,3p^4(^3P)5d$	$5d\ ^4F$	4½	99513.68	−150.47	1.310
		3½	99664.15	−97.37	1.181
		2½	99761.52	−183.90	1.149
		1½	99945.42		1.240
$3s^2\,3p^4(^3P)4d$	$4d\ ^2P$	1½	99530.10	−176.90	1.306
		½	99707.00		1.289
$3s^2\,3p^4(^3P)6p$	$1°\ (^2D?)$	1½	99564.7		1.32
$3s^2\,3p^4(^3P)6p$	$2°\ (^4D°?)$	½	99582.7		0.49
$3s^2\,3p^4(^3P)7s?$	$1\ (^4P?)$	1½	99677.1		1.73
$3s^2\,3p^4(^3P)6p$	$6p\ ^2P°$	1½	99819.8	−79.4	1.28
		½	99899.2		0.81
$3s^2\,3p^4(^3P)7s?$	$2\ (^2P?)$	½	99968.1		1.21
$3s^2\,3p^4(^3P)5d$	$5d\ ^4P$	2½	99984.30	−248.70	1.589
		1½	100233.00	65.88	
		½	100167.12		1.470
$3s^2\,3p^4(^3P)7s?$	$3\ (^2P?)$	1½	100046.5		1.42
$3s^2\,3p^4(^3P)5d$	$5d\ ^2F$	3½	100142.41	−442.87	1.210
		2½	100585.28		1.069
$3s^2\,3p^4(^3P)5d$	$5d\ ^2D$	2½	100245.32	−97.66	
		1½	100342.98		
$3s^2\,3p^4(^3P)5d$	$5d\ ^2P$	1½	100700.3	−33.1	1.65
		½	100733.4		1.59
$3s^2\,3p^4(^3P)6d$	$6d\ ^4D$	½	100941.9	99.7	1.010
		1½	101041.6	6.9	1.168
		2½	101048.47	−62.87	1.364
		3½	100985.60		1.377
$3s^2\,3p^4(^3P)6d$	$4\ (^4F?)$	1½?	101219.0		1.20
$3s^2\,3p^4(^3P)6d$	$5\ (^4P?)$	2½	101422.4		1.60
$3s^2\,3p^4(^3P)6d$	6	½	101587.4		0.69
$3s^2\,3p^4(^3P)6d$	$7\ (^2F?)$	2½	101855.0		1.45
Cl II $(^3P_2)$	*Limit*	------	*104991*		

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Cl I Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms							
$3s^2\,3p^5$	$3p^5\ ^2P°$							
	$ns\ (n\geq 4)$		$np\ (n\geq 4)$				$nd\ (n\geq 3)$	
$3s^2\,3p^4(^3P)nx$	$\Big\{\begin{array}{l}4,6s\ ^4P\\4s\ ^2P\end{array}$		$4,5p\ ^4S°$ $4,5p\ ^2S°$	$4\text{–}6p\ ^4P°$ $4\text{–}6p\ ^2P°$	$4\text{–}6p\ ^4D°$ $4,5p\ ^2D°$		$4,5d\ ^4P$ $4,5d\ ^2P$	$4\text{–}6d\ ^4D$ $4,5d\ ^2D$ $\quad4,5d\ ^4F$ $4,5d\ ^2F$
$3s^2\,3p^4(^1D)nx'$	$4s'\ ^2D$		$4p'\ ^2P°$	$4p'\ ^2D°$ $4p'\ ^2F°$				

*For predicted terms in the spectra of the Cl I isoelectronic sequence, see Introduction.

Cl II

(S I sequence; 16 electrons) $Z=17$

Ground state $1s^2\, 2s^2\, 2p^6\, 3s^2\, 3p^4\; {}^3P_2$

$3p^4\; {}^3P_2$ **192000 cm^{-1}**   I. P. 23.80 volts

The terms are from the paper by Kiess and de Bruin, who have summarized, revised, and extended the earlier analysis by Murakawa and others. They give a complete list of classified lines; it extends from 558 A to 9483 A. Intersystem combinations connecting all three systems of terms, have been observed.

The two unclassified levels designated by them as x' and x'' are here labeled 1 and 2, respectively. The term they list as $4s'\,{}^3P$ is entered as "${}^3P$" since its configuration is not definitely known.

The estimated position of $3p^4\,{}^1S$ given by Edlén, is entered in brackets in the table.

REFERENCES

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<div style="text-align:center">Cl II   Cl II</div>

Config.	Desig.		J	Level	Interval	Config.	Desig.		J	Level	Interval
$3s^2\,3p^4$	$3p^4$	${}^3P$	2	0	-697	$3s^2\,3p^3({}^2D^\circ)3d$	$3d'$	${}^1P^\circ$	1	127726.9	
			1	697	-299	$3s^2\,3p^3({}^4S^\circ)4p$	$4p$	${}^5P$	1	128621.9	
			0	996					2	128662.5	40.6
$3s^2\,3p^4$	$3p^4$	${}^1D$	2	11652					3	128729.8	67.3
$3s^2\,3p^4$	$3p^4$	${}^1S$	0	[27900]		$3s^2\,3p^3({}^2D^\circ)4s$	$4s'$	${}^1D^\circ$	2	129065.4	
$3s\,\,3p^5$	$3p^5$	${}^3P^\circ$	2	93366.6	-632.1	$3s^2\,3p^3({}^4S^\circ)4p$	$4p$	${}^3P$	2	131767.4	
			1	93998.7	-334.1				1	131754.8	12.6
			0	94332.8					0	131768.0	-13.2
$3s^2\,3p^3({}^4S^\circ)4s$	$4s$	${}^5S^\circ$	2	107878.5		$3s^2\,3p^3({}^2D^\circ)3d$	$3d'$	${}^3G^\circ$	3	132162.1	
$3s^2\,3p^3({}^4S^\circ)3d$	$3d$	${}^5D^\circ$	4	110295.8					4	132173.4	11.3
			3	110296.8	-1.0				5	132191.3	17.9
			2	110299.5	-2.7	$3s^2\,3p^3({}^2P^\circ)4s$	$4s''$	${}^3P^\circ$	0	137770.1	
			1	110302.0	-2.5				1	137804.4	34.3
			0	110303.5	-1.5				2	137877.6	73.2
$3s^2\,3p^3({}^4S^\circ)4s$	$4s$	${}^3S^\circ$	1	112608.0		$3s^2\,3p^3({}^2P^\circ)4s$	$4s''$	${}^1P^\circ$	1	138623.0	
$3s\,\,3p^5$	$3p^5$	${}^1P^\circ$	1	115656.4		$3s^2\,3p^3({}^2P^\circ)3d$	$3d''$	${}^1P^\circ$	1	139350.0	
$3s^2\,3p^3({}^4S^\circ)3d$	$3d$	${}^3D^\circ$	3	119809.9	10.9	$3s^2\,3p^3({}^2P^\circ)3d$	$3d''$	${}^1D^\circ$	2	140259.1	
			2	119799.0	-43.1	$3s^2\,3p^3({}^2P^\circ)3d$	$3d''$	${}^3D^\circ$	1	140740.0	
			1	119842.1					2	141010.0	270.0
$3s^2\,3p^3({}^2D^\circ)3d$	$3d'$	${}^1D^\circ$	2	121498.6					3	141349.6	339.6
$3s^2\,3p^3({}^2D^\circ)3d$	$3d'$	${}^1F^\circ$	3	121635.1		$3s^2\,3p^3({}^2P^\circ)3d$	$3d''$	${}^3F^\circ$	4	143996.3	
$3s^2\,3p^3({}^2D^\circ)3d$	$3d'$	${}^3F^\circ$	2	126031.8					3	144174.5	-178.2
			3	126219.1	187.3				2	144343.6	-169.1
			4	126456.6	237.5	$3s^2\,3p^3({}^2D^\circ)4p$	$4p'$	${}^1P$	1	145468.5	
$3s^2\,3p^3({}^2D^\circ)4s$	$4s'$	${}^3D^\circ$	1	126725.1		$3s^2\,3p^3({}^2P^\circ)3d$	$3d''$	${}^3P^\circ$	0		
			2	126743.3	18.2				1		
			3	126782.8	39.5				2	146012.9	

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^3(^2D°)4p$	$4p'$ ^3D	1 2 3	146330.0 146333.8 146469.0	3.8 135.2	$3s^2\,3p^3(^4S°)5d$	$5d$ $^5D°$	0 1 2 3 4	 169799.1 169799.6 169800.2	 0.5 0.6
$3s^2\,3p^3(^2D°)4p$	$4p'$ ^3F	2 3 4	147053.7 147125.7 147198.4	72.0 72.7	$3s^2\,3p^3(^2D°)5s$	$5s'$ $^3D°$	1 2 3	170514.7 170535.1 170575.5	20.4 40.4
$3s^2\,3p^3(^2D°)4p$	$4p'$ ^1F	3	147605.7		$3s^2\,3p^3(^4S°)5d$	$5d$ $^3D°$	3 2 1	170973.6 171005.8 171051.5	-32.2 -45.7
$3s^2\,3p^3(^2D°)4p$	$4p'$ ^3P	2 1 0	149798.3 149952.4 150019.0	-154.1 -66.6	$3s^2\,3p^3(^2D°)5s$	$5s'$ $^1D°$	2	171209.2	
$3s^2\,3p^3(^2D°)3d$	$3d'$ $^3P°$	2 1 0	150681.4 150812.7	-131.3	$3s^2\,3p^3(^2D°)4d$	$4d'$ $^3F°$	2 3 4	172572.6 172650.3 172740.9	77.7 90.6
$3s^2\,3p^3(^2D°)3d$	$3d'$ $^3D°$	3 2 1	151092.7 151018.6 151133.8	74.1 -115.2	$3s^2\,3p^3(^2D°)4d$	$4d'$ $^3G°$	3 4 5	173222.7 173243.9 173277.5	21.2 33.6
$3s^2\,3p^3(^4S°)5s$	$5s$ $^5S°$	2	152233.1		$3s^2\,3p^3(^2D°)4d$	$4d'$ $^1F°$	3	174045.0	
$3s^2\,3p^3(^2D°)4p$	$4p'$ ^1D	2	153257.0			2	2	174256.3	
$3s^2\,3p^3(^2D°)3d$	$3d'$ $^3S°$	1	153571.2		$3s^2\,3p^3(^2D°)4d$	$4d'$ $^3D°$	1 2 3	174785.7 174820.6 174852.6	34.9 32.0
$3s^2\,3p^3(^4S°)5s$	$5s$ $^3S°$	1	153633.1		$3s^2\,3p^3(^2D°)4d$	$4d'$ $^3S°$	1	177423.1	
$3s^2\,3p^3(^4S°)4d$	$4d$ $^5D°$	0 1 2 3 4	154616.7 154617.8 154619.6 154622.6 154623.8	1.1 1.8 3.0 1.2	$3s^2\,3p^3(^2D°)4d$	$4d'$ $^3P°$	0 1 2	177693.6 177754.2 177816.9	60.6 62.7
$3p^5\,(^2P°)4s$	$4s^{VII}$ $^3P°$	2 1 0	157076.6 157666.8 157956.8	-590.2 -290.0	$3s^2\,3p^3(^2D°)4d$	$4d'$ $^1D°$	2	178539.1	
$3s^2\,3p^3(^2P°)4p$	$4p''$ ^3S	1	158177.1		$3s^2\,3p^3(^2D°)4d$	$4d'$ $^1P°$	1	179867.0	
$3s^2\,3p^3(^2P°)4p$	$4p''$ ^3D	1 2 3	158723.7 158768.6 158786.4	44.9 17.8	$3s^2\,3p^3(^2P°)5s$	$5s''$ $^3P°$	0 1 2	182337.9 182372.3 182448.7	34.4 76.4
$3s^2\,3p^3(^2P°)4p$	$4p''$ ^1D	2	159574.2		$3s^2\,3p^3(^2P°)4d$	$4d''$ $^3F°$	4 3 2	184628.1 184655.2 184658.4	-27.1 -3.2
$3s\,3p^4(?)4s$	^3P	0 1 2	159840.3 159999.6 160143.4	159.3 143.8	$3s^2\,3p^3(^2P°)4d$	$4d''$ $^3P°$	2 1 0	185765.0 185905.4	-140.4
$3s^2\,3p^3(^2P°)4p$	$4p''$ ^1P	1	161348.4						
$3s^2\,3p^3(^2P°)4p$	$4p''$ ^3P	2 1 0	161634.9 161654.8 161671.0	-19.9 -16.2	$3s^2\,3p^3(^2P°)4d$	$4d''$ $^3D°$	1 2 3	 185865.2	
$3s^2\,3p^3(^4S°)4d$	$4d$ $^3D°$	3 2 1	161796.5 161907.7 161989.8	-111.2 -82.1	$3s^2\,3p^3(^2D°)6s$	$6s'$ $^3D°$	1 2 3	186844.3 186861.0 186898.3	16.7 37.3
	1	2	164210.7		$3s^2\,3p^3(^2D°)6s$	$6s'$ $^1D°$	2	187141.4	
$3s^2\,3p^3(^2P°)4p$	$4p''$ ^1S	0	165362.1						
$3s^2\,3p^3(^4S°)6s$	$6s$ $^5S°$	2	168673.6		Cl III ($^4S_{1½}$)	Limit		192000	
$3s^2\,3p^3(^4S°)6s$	$6s$ $^3S°$	1	169246.6						

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Config. $1s^2\,2s^2\,2p^6+$	Observed Terms					
$3s^2\,3p^4$	$3p^4$ ^{3}P	$3p^4$ ^{1}D				
$3s\,3p^5$	$3p^5$ ^{3}P° $3p^5$ ^{1}P°					

	ns $(n \geq 4)$		np $(n \geq 4)$			
$3s^2\,3p^3(^4$S°$)nx$	$4\text{--}6s$ ^{5}S° $4\text{--}6s$ ^{3}S°		$4p$ ^{5}P $4p$ ^{3}P			
$3s^2\,3p^3(^2$D°$)nx'$		$4\text{--}6s'$ ^{3}D° $4\text{--}6s'$ ^{1}D°	$4p'$ ^{3}P $4p'$ ^{1}P	$4p'$ ^{3}D $4p'$ ^{1}D	$4p'$ ^{3}F $4p'$ ^{1}F	
$3s^2\,3p^3(^2$P°$)nx''$	$4,\,5s''$ ^{3}P° $4s''$ ^{1}P°		$4p''$ ^{3}S $4p''$ ^{1}S	$4p''$ ^{3}P $4p''$ ^{1}P	$4p''$ ^{3}D $4p''$ ^{1}D	
$3p^5(^2$P°$)nx^{\mathrm{VII}}$	$4s^{\mathrm{VII}}$ ^{3}P°					

	nd $(n \geq 3)$				
$3s^2\,3p^3(^4$S°$)nx$	$3\text{--}5d$ ^{5}D° $3\text{--}5d$ ^{3}D°				
$3s^2\,3p^3(^2$D°$)nx'$	$3,\,4d'$ ^{3}S° $3,\,4d'$ ^{1}P°	$3,\,4d'$ ^{3}P° 	$3,\,4d'$ ^{3}D° $3,\,4d'$ ^{1}D°	$3,\,4d'$ ^{3}F° $3,\,4d'$ ^{1}F°	$3,\,4d'$ ^{3}G°
$3s^2\,3p^3(^2$P°$)nx''$	$3,\,4d''$ ^{3}P° $3d''$ ^{1}P°	$3,\,4d''$ ^{3}D° $3d''$ ^{1}D°	$3,\,4d''$ ^{3}F°		

*For predicted terms in the spectra of the S I isoelectronic sequence, see Introduction.

Cl III

(P I sequence; 15 electrons) $Z=17$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^3$ ^{4}S°$_{1\frac{1}{2}}$

$3p^3$ ^{4}S°$_{1\frac{1}{2}}$ **321936** cm^{-1} I. P. 39.90 volts

The terms are from Bowen, who has greatly extended the early work on this spectrum. About 300 lines have been classified, and the observations range from 406 A to 4971 A. Intersystem combinations connecting the doublet and quartet terms have been observed.

Bowen remarks that because of perturbations the designations of the doublet levels of the $3d$ configuration are somewhat uncertain.

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I. S. Bowen, Phys. Rev. **45**, 401 (1934). (I P) (T) (C L)

Cl III

Config.	Desig.	J	Level	Interval
$3s^2\,3p^3$	$3p^3\ {}^4S^\circ$	1½	0.0	
$3s^2\,3p^3$	$3p^3\ {}^2D^\circ$	1½	18053	
		2½	18120	67
$3s^2\,3p^3$	$3p^3\ {}^2P^\circ$	½	29812	
		1½	29907	95
$3s\ \ 3p^4$	$3p^4\ {}^4P$	2½	98520	
		1½	99130	−610
		½	99475	−345
$3s^2\,3p^2({}^3P)3d$	$3d\ {}^4F$	1½	146525.6	
		2½	146749.9	224.3
		3½	147073.0	323.1
		4½	147497.9	424.9
$3s^2\,3p^2({}^3P)3d$	$3d\ {}^4D$	½	151946.4	
		1½	151879.9	−66.5
		2½	151848.6	−31.3
		3½	151953.5	104.9
$3s^2\,3p^2({}^3P)4s$	$4s\ {}^4P$	½	173736.0	
		1½	174093.8	357.8
		2½	174613.9	520.1
$3s^2\,3p^2({}^3P)4s$	$4s\ {}^2P$	½	178369.7	
		1½	179076.1	706.4
$3s^2\,3p^2({}^3P)3d$	$3d\ {}^4P$	2½	179495.2	
		1½	179663.5	−168.3
		½	179781.0	−117.5
$3s^2\,3p^2({}^3P)3d$	$3d\ {}^2D$	1½	182076.3	
		2½	183042.7	966.4
$3s^2\,3p^2({}^3P)3d$	$3d\ {}^2P$	1½	185838.3	
		½	186220.4	−382.1
$3s^2\,3p^2({}^1D)4s$	$4s'\ {}^2D$	2½	188390.1	
		1½	188448.1	−58.0
$3s^2\,3p^2({}^1D)3d$	$3d'\ {}^2D$	2½	194959.5	
		1½	195268.2	−308.7
$3s^2\,3p^2({}^1D)3d$	$3d'\ {}^2F$	2½	196137.9	
		3½	196155.8	17.9
$3s^2\,3p^2({}^1D)3d$	$3d'\ {}^2P$	½	198835.5	
		1½	198983.9	148.4
$3s^2\,3p^2({}^3P)4p$	$4p\ {}^4D^\circ$	½	201073.4	
		1½	201332.0	258.6
		2½	201765.1	433.1
		3½	202367.6	602.5

Cl III

Config.	Desig.	J	Level	Interval
$3s^2\,3p^2({}^3P)4p$	$4p\ {}^4P^\circ$	½	204021.6	
		1½	204124.0	102.4
		2½	204541.2	417.2
$3s^2\,3p^2({}^3P)4p$	$4p\ {}^2D^\circ$	1½	205037.3	
		2½	205946.9	909.6
$3s^2\,3p^2({}^3P)4p$	$4p\ {}^4S^\circ$	1½	205938.5	
$3s^2\,3p^2({}^3P)4p$	$4p\ {}^2P^\circ$	½	209042.1	
		1½	209182.8	140.7
$3s^2\,3p^2({}^1D)4p$	$4p'\ {}^2F^\circ$	2½	216524.6	
		3½	216710.4	185.8
$3s^2\,3p^2({}^1D)4p$	$4p'\ {}^2D^\circ$	2½	217850.2	
		1½	217913.1	−62.9
$3s^2\,3p^2({}^1D)4p$	$4p'\ {}^2P^\circ$	½	221862.9	
		1½	222100.7	237.8
$3s^2\,3p^2({}^3P)4d$	$4d\ {}^4F$	1½	239506.3	
		2½	239729.9	223.6
		3½	240075.2	345.3
		4½	240568.4	493.2
$3s^2\,3p^2({}^3P)4d$	$4d\ {}^4D$	½	241559.4	
		1½	241572.4	13.0
		2½	241685.1	112.7
		3½	242046.2	361.1
$3s^2\,3p^2({}^3P)4d$	$4d\ {}^4P$	2½	242822.8	
		1½	243080.7	−257.9
		½	243207.2	−126.5
$3s^2\,3p^2({}^3P)4d$	$4d\ {}^2F$	2½	243828.4	
		3½	244684.9	856.5
$3s^2\,3p^2({}^3P)5s$	$5s\ {}^4P$	½	244951.5	
		1½	245392.4	440.9
		2½	246137.2	744.8
$3s^2\,3p^2({}^3P)4d$	$4d\ {}^2D$	1½	248528.2	
		2½	248657.7	129.5
$3s^2\,3p^2({}^1D)4d$	$4d'\ {}^2D$	1½	254612.7?	
		2½	254683.4?	70.7
$3s^2\,3p^2({}^1D)4d$	$4d'\ {}^2F$	3½	255086.3	
		2½	255140.4	−54.1
$3s^2\,3p^2({}^1D)5s$	$5s'\ {}^2D$	2½	258885.8	
		1½	258890.8	−5.0
Cl IV $({}^3P_0)$	*Limit*		*321936*	

November 1947.

Cl III Observed Terms*

Config. $1s^2\,2s^2\,2p^6 +$	Observed Terms			
$3s^2\,3p^3$	$\{$ $3p^3\ {}^4S^\circ$ $\quad$ $3p^3\ {}^2P^\circ$ $\quad$ $3p^3\ {}^2D^\circ$			
$3s\ \ 3p^4$	$3p^4\ {}^4P$			

	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\,3p^2({}^3P)nx$	$\{$ 4, 5s ${}^4P$ 4s ${}^2P$	4p ${}^4S^\circ$ $\quad$ 4p ${}^4P^\circ$ $\quad$ 4p ${}^4D^\circ$ 4p ${}^2P^\circ$ $\quad$ 4p ${}^2D^\circ$	3, 4d ${}^4P$ $\quad$ 3, 4d ${}^4D$ $\quad$ 3, 4d ${}^4F$ 3d ${}^2P$ $\quad$ 3, 4d ${}^2D$ $\quad$ 4d ${}^2F$
$3s^2\,3p^2({}^1D)nx'$	4, 5s' ${}^2D$	4p' ${}^2P^\circ$ $\quad$ 4p' ${}^2D^\circ$ $\quad$ 4p' ${}^2F^\circ$	3d' ${}^2P$ $\quad$ 3, 4d' ${}^2D$ $\quad$ 3, 4d' ${}^2F$

*For predicted terms in the spectra of the P I isoelectronic sequence, see Introduction.

Cl IV

(Si I sequence; 14 electrons) $Z=17$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^2\,{}^3\mathrm{P}_0$

$3p^2\,{}^3\mathrm{P}_0$ **431226** cm^{-1} I. P. 53.5 volts

The analysis is by Bowen, who has classified 84 lines in the range between 318 A and 3167 A. The singlet and triplet terms are connected by intersystem combinations. Bowen classifies three lines (437 A–440 A) as $3p^3\,{}^5\mathrm{S}°-4s\,{}^5\mathrm{P}$, but lists no quintet terms.

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S. C. Deb, Acad. Sci. Allahabad Bul. **2,** 49 (1932).   (I P) (T) (C L)
I. S. Bowen, Phys. Rev. **45,** 401 (1934).   (I P) (T) (C L)
I. S. Bowen, Phys. Rev. **46,** 377 (1934).   (T) (C L)

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^2$	$3p^2\,{}^3\mathrm{P}$	0	0	491	$3s^2\,3p(^2\mathrm{P}°)4s$	$4s\,{}^3\mathrm{P}°$	0	*215026. 0*	363. 3
		1	491	850			1	*215389. 3*	1078. 8
		2	1341				2	*216468. 1*	
$3s^2\,3p^2$	$3p^2\,{}^1\mathrm{D}$	2	13766		$3s^2\,3p(^2\mathrm{P}°)4s$	$4s\,{}^1\mathrm{P}°$	1	*219454*	
$3s^2\,3p^2$	$3p^2\,{}^1\mathrm{S}$	0	32550		$3s^2\,3p(^2\mathrm{P}°)4p$	$4p\,{}^3\mathrm{D}$	1	247575. 1?	451. 0
$3s\,3p^3$	$3p^3\,{}^3\mathrm{D}°$	1	*102752*	35			2	248026. 1	935. 1
		2	*102787*	82			3	248961. 2	
		3	*102869*		$3s^2\,3p(^2\mathrm{P}°)4p$	$4p\,{}^3\mathrm{P}$	0	251471. 4	254. 4
$3s\,3p^3$	$3p^3\,{}^3\mathrm{P}°$	2	*120256*	-18			1	251725. 8	670. 9
		1	*120274*	-26			2	252396. 7	
		0	*120300*		$3s^2\,3p(^2\mathrm{P}°)5s$	$5s\,{}^3\mathrm{P}°$	0	*312747*	244
$3s\,3p^3$	$3p^3\,{}^3\mathrm{S}°$	1	*164721*				1	*312991*	1234
							2	*314225*	
$3s\,3p^3$	$3p^3\,{}^1\mathrm{P}°$	1	*166742*		$3s^2\,3p(^2\mathrm{P}°)5s$	$5s\,{}^1\mathrm{P}°$	1	*315121*	
$3s^2\,3p(^2\mathrm{P}°)3d$	$3d\,{}^3\mathrm{P}°$	2	*181643*	-430					
		1	*182073*	-227	Cl v $(^2\mathrm{P}°_{\frac12})$	*Limit*		431226	
		0	*182300*						
$3s^2\,3p(^2\mathrm{P}°)3d$	$3d\,{}^3\mathrm{D}°$	1	*187008*	166					
		2	*187174*	172					
		3	*187346*						

October 1947.

Cl IV OBSERVED TERMS*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2\,3p^2$	$\begin{cases} & 3p^2\ ^3\mathrm{P} \\ 3p^2\ ^1\mathrm{S} & \quad 3p^2\ ^1\mathrm{D} \end{cases}$		
$3s\,\,3p^3$	$\begin{cases} 3p^3\ ^3\mathrm{S}^\circ & 3p^3\ ^3\mathrm{P}^\circ\ \ 3p^3\ ^3\mathrm{D}^\circ \\ & 3p^3\ ^1\mathrm{P}^\circ \end{cases}$		
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\,3p(^2\mathrm{P}^\circ)nx$	$\begin{cases} 4,5s\ \ ^3\mathrm{P}^\circ \\ 4,5s\ \ ^1\mathrm{P}^\circ \end{cases}$	$4p\ ^3\mathrm{P} \qquad 4p\ ^3\mathrm{D}$	$3d\ ^3\mathrm{P}^\circ \qquad 3d\ ^3\mathrm{D}^\circ$

*For predicted terms in the spectra of the Si I isoelectronic sequence, see Introduction.

Cl V

(Al I sequence; 13 electrons) $Z=17$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\ ^2\mathrm{P}^\circ_{1/2}$

$3p\ ^2\mathrm{P}^\circ_{1/2}$ *547000* cm^{-1} I. P. 67.80 volts

The analysis is by Bowen except for the revision of $3d\ ^4\mathrm{P}^\circ$ and the addition of $5d\ ^2\mathrm{D}$ suggested by Phillips and Parker. Forty-two lines have been classified in the interval between 236 A and 894 A.

No intersystem combinations connecting the doublet and quartet systems of terms have been observed, as indicated by x in the table.

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S. C. Deb, Acad. Sci. Allahabad Bull. **2**, 43 (1932).   (T) (C L)
I. S. Bowen, Phys. Rev. **45**, 401 (1934).   (I P) (T) (C L)
L. W. Phillips and W. L. Parker, Phys. Rev. **60**, 306 (1941).   (T) (C L)

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$3p\ ^2P^\circ$	½ 1½	*0* *1492*	1492	$3s\ 3p(^3P^\circ)3d$	$3d\ ^4P^\circ$	2½ 1½ ½	*269986+x* *270423+x* *270745+x*	−437 −322
$3s\ 3p^2$	$3p^2\ ^4P$	½ 1½ 2½	86000+x 86538+x 87381+x	538 843	$3s\ 3p(^3P^\circ)3d$	$3d\ ^4D^\circ$	½ 1½ 2½ 3½	*272596+x* *272757+x* *272919+x* *273020+x*	161 162 101
$3s\ 3p^2$	$3p^2\ ^2D$	1½ 2½	113234 113306	72					
$3s\ 3p^2$	$3p^2\ ^2S$	½	146644		$3s^2(^1S)4d$	$4d\ ^2D$	{ 1½ 2½ }	349511	
$3s\ 3p^2$	$3p^2\ ^2P$	½ 1½	157931 158892	961	$3s\ 3p(^3P^\circ)4s$	$4s\ ^4P^\circ$	½ 1½ 2½	*353445+x* *353978+x* *354925+x*	533 947
$3s^2(^1S)3d$	$3d\ ^2D$	1½ 2½	185861 185893	32	$3s^2(^1S)5d$	$5d\ ^2D$	1½ 2½	422949 423022	73
$3p^3$	$3p^3\ ^4S^\circ$	1½	*233757+x*						
$3s^2(^1S)4s$	$4s\ ^2S$	½	256313		Cl VI ($^1S_0$)	*Limit*		**547000**	

September 1947.

<div align="center">

Cl V Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6+$	Observed Terms		
$3s^2(^1S)3p$	$3p\ ^2P^\circ$		
$3s\ 3p^2$	{ $3p^2\ ^2S$ $3p^2\ ^4P$ $3p^2\ ^2P$ $3p^2\ ^2D$		
$3p^3$	$3p^3\ ^4S^\circ$		
	ns $(n \geq 4)$		*nd* $(n \geq 3)$
$3s^2(^1S)nx$	$4s\ ^2S$		$3\text{–}5d\ ^2D$
$3s\ 3p(^3P^\circ)nx$		$4s\ ^4P^\circ$	$3d\ ^4P^\circ$ $3d\ ^4D^\circ$

</div>

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

Cl VI

(Mg I sequence; 12 electrons) $\qquad$ $Z=17$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ ^1S_0$

$3s^2\ ^1S_0\ 780000\pm$ cm^{-1} $\qquad\qquad$ I. P. $96.7\pm$ volts

The analysis is incomplete. One singlet combination has been given by Bowen and Millikan, a line at 671.37 A classified as $3s^2\ ^1S_0 - 3p\ ^1P_1^\circ$. The triplet terms are from Phillips and Parker, who have classified 34 lines in the range 194 A to 736 A.

From isoelectronic sequence data the writer has estimated the approximate value of the limit, and of $3p\ ^3P_1^\circ$ above the ground state zero. All triplet terms have, consequently, been increased by 98147 cm^{-1}. The estimated values are entered in brackets in the table. The uncertainty, x, may be several hundred cm^{-1}.

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I. S. Bowen and R. A. Millikan, Phys. Rev. **25**, 597 (1925). (C L)

W. L. Parker and L. W. Phillips, Phys. Rev. **57**, 140 (1940). (T) (C L)

L. W. Phillips and W. L. Parker, Phys. Rev. **60**, 306 (1941). (T) (C L)

Cl VI

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2$ ^{1}S	0	0		$3p(^2$P$^\circ)3d$	$3d$ ^{3}D$^\circ$	1	*411802* +x	
							2	*412075* +x	273
$3s(^2$S$)3p$	$3p$ ^{3}P$^\circ$	0	*[98147]*+x				3	*412228* +x	153
		1	*98700* +x	553					
		2	*99865* +x	1165	$3s(^2$S$)4d$	$4d$ ^{2}D	1	*509868* +x	
$3s(^2$S$)3p$	$3p$ ^{1}P$^\circ$	1	*148949*				2	*509896* +x	28
$3p^2$	$3p^2$ ^{3}P	0	*234960* +x				3	*509947* +x	51
		1	*235596* +x	636	$3s(^2$S$)4f$	$4f$ ^{3}F$^\circ$	2, 3, 4	*529889* +x	
		2	*236797* +x	1201	$3s(^2$S$)5d$	$5d$ ^{3}D	1		
$3s(^2$S$)3d$	$3d$ ^{3}D	1	*279845* +x				2	*612058* +x	31
		2	*279860* +x	15			3	*612089* +x	
		3	*279888* +x	28					
$3s(^2$S$)4s$	$4s$ ^{3}S	1	*407404* +x		Cl VII (^{2}S$_{1/2}$)	*Limit*	--------	*[780000]*	
$3p(^2$P$^\circ)3d$	$3d$ ^{3}P$^\circ$	2	*409079* +x						
		1	*409975* +x	−896					
		0	*410762* +x	−787					

July 1947.

Cl VI Observed Terms*

Config. 1s² 2s² 2p⁶+	Observed Terms		
3s²	3s² ¹S		
3s(²S)3p	{ 3p ³P° 3p ¹P°		
3p²	3p² ³P		
	ns (n ≥ 4)	nd (n ≥ 3)	nf (n ≥ 4)
3s(²S)nx	4s ³S	3–5d ³D	4f ³F°
3p(²P°)nx		3d ³P° 3d ³D°	

*For predicted terms in the spectra of the Mg I isoelectronic sequence, see Introduction.

Cl VII

(Na I sequence; 11 electrons) $Z=17$

Ground state $1s^2\,2s^2\,2p^6\,3s\ ^2S_{1/2}$

$3s\ ^2S_{1/2}$ **921902** cm⁻¹   I. P. 114.27 volts

The resonance lines were observed by Bowen and Millikan. The analysis was extended by Phillips to include 22 classified lines in the interval between 174 A and 813 A. Absolute term values were derived from the $3d\text{-}nf$ series.

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I. S. Bowen and R. A. Millikan, Phys. Rev. **25**, 295 (1925). (C L)
L. W. Phillips, Phys. Rev. **53**, 248 (1938). (I P) (T) (C L)

Cl VII   Cl VII

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
3s	3s ²S	½	0		4f	4f ²F°	2½ 3½	584086 584099	13
3p	3p ²P°	½ 1½	123001 124891	1890	5s	5s ²S	½	647677	
3d	3d ²D	1½ 2½	290166 290239	73	5d	5d ²D	1½ 2½	697598 697619	21
4s	4s ²S	½	464003		5f	5f ²F°	2½ 3½	705398 705409	11
4p	4p ²P°	½ 1½	509197 509885	688	6f	6f ²F°	{ 2½ 3½ }	771549	
4d	4d ²D	1½ 2½	569142 569182	40					
					Cl VIII (¹S₀)	Limit		921902	

June 1947.

Cl VIII

(Ne I sequence; 10 electrons) $Z=17$

Ground state $1s^2\,2s^2\,2p^6\,{}^1S_0$

$2p^6\,{}^1S_0$ 2810000 ± 500 cm^{-1} I. P. 348.3 ± 0.1 volts

Edlén has classified 13 lines in the region between 39A and 59A, as combinations with the ground term. The terms from the (^2S) limit in Cl IX need further confirmation.

As for Ne I the jl-coupling notation in the general form suggested by Racah is introduced. The unit 10^3 cm^{-1} used by Edlén has here been converted to cm^{-1}.

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B. Edlén, Zeit. Phys. **100**, 726 (1936). (I P) (T) (C L)
G. Racah, Phys. Rev. **61**, 537 (L) (1942).

Cl VIII

Edlén	Config.	Desig.	J	Level	Edlén	Config.	Desig.	J	Level
$2p\ {}^1S_0$	$2s^2\,2p^6$	$2p^6\ {}^1S$	0	0	$4d\ {}^1P_1$	$2s^2\,2p^5(^2P^o_{1\frac{1}{2}})4d$	$4d\,[1\frac{1}{2}]^o$	1	*2356820*
					$4d\ {}^3D_1$	$2s^2\,2p^5(^2P^o_{\frac{1}{2}})4d$	$4d'[1\frac{1}{2}]^o$	1	*2368550*
$3s\ {}^3P_1$	$2s^2\,2p^5(^2P^o_{1\frac{1}{2}})3s$	$3s\,[1\frac{1}{2}]^o$	2 1	*1689450*		$2s\ \ 2p^6(^2S)3p$	$3p\ {}^3P^o$	2 1 0	*2371580?*
$3s\ {}^1P_1$	$2s^2\,2p^5(^2P^o_{\frac{1}{2}})3s$	$3s'[\ \frac{1}{2}]^o$	0 1	*1704360*	$3p'\ {}^3P_1$				
$3d\ {}^3P_1$	$2s^2\,2p^5(^2P^o_{1\frac{1}{2}})3d$	$3d\,[\ \frac{1}{2}]^o$	0 1	*1972390*	$3p'\ {}^1P_1$	$2s\ \ 2p^6(^2S)3p$	$3p\ {}^1P^o$	1	*2401770?*
$3d\ {}^1P_1$	''	$3d\,[1\frac{1}{2}]^o$	1	*1997040*	$5d\ {}^1P_1$	$2s^2\,2p^5(^2P^o_{1\frac{1}{2}})5d$	$5d\,[1\frac{1}{2}]^o$	1	*2521750*
$3d\ {}^3D_1$	$2s^2\,2p^5(^2P^o_{\frac{1}{2}})3d$	$3d'[1\frac{1}{2}]^o$	1	*2020730*	$5d\ {}^3D_1$	$2s^2\,2p^5(^2P^o_{\frac{1}{2}})5d$	$5d'[1\frac{1}{2}]^o$	1	*2534080*
$4s\ {}^3P_1$	$2s^2\,2p^5(^2P^o_{1\frac{1}{2}})4s$	$4s\,[1\frac{1}{2}]^o$	2 1	*2242000*		Cl IX $(^2P^o_{1\frac{1}{2}})$	*Limit*		2810000
$4s\ {}^1P_1$	$2s^2\,2p^5(^2P^o_{\frac{1}{2}})4s$	$4s'[\ \frac{1}{2}]^o$	0 1	*2254200*		Cl IX $(^2P^o_{\frac{1}{2}})$	*Limit*		2823600

April 1947.

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^6$	$2p^6\ {}^1S$		
	$ns\ (n \geq 3)$	$np\ (n \geq 3)$	$nd\ (n \geq 3)$
$2s^2\,2p^5({}^2P^\circ)nx$	$\left\{\begin{array}{l} 3,4s\quad {}^3P^\circ \\ 3,4s\quad {}^1P^\circ \end{array}\right.$		$3d\ {}^3P^\circ\quad 3\text{-}5d\ {}^3D^\circ$ $3\text{-}5d\ {}^1P^\circ$
$2s\ 2p^6({}^2S)nx$	$\left\{\begin{array}{l} \\ \end{array}\right.$	$3p\ {}^3P^\circ$ $3p\ {}^1P^\circ$	

jl-Coupling Notation

	Observed Pairs		
	$ns\ (n \geq 3)$		$nd\ (n \geq 3)$
$2s^2\,2p^5({}^2P^\circ_{1\frac{1}{2}})nx$	$3,4s\ [1\frac{1}{2}]^\circ$		$3d\ [\ \frac{1}{2}]^\circ$ $3\text{-}5d\ [1\frac{1}{2}]^\circ$
$2s^2\,2p^5({}^2P^\circ_{\frac{1}{2}})nx'$	$3,4s'\ [\ \frac{1}{2}]^\circ$		$3\text{-}5d'\ [1\frac{1}{2}]^\circ$

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

Cl IX

(F I sequence; 9 electrons) $Z=17$

Ground state $1s^2\,2s^2\,2p^5\ {}^2P^\circ_{1\frac{1}{2}}$

$2p^5\ {}^2P^\circ_{1\frac{1}{2}}$ *3233000* cm^{-1} I. P. 400.7 volts

Edlén has classified 34 lines in this spectrum in the interval 42 A to 53 A. The absolute value of the ground state has been extrapolated. Since no combinations between the two lowest terms have been observed, relative values have been extrapolated from the irregular doublet law for the three terms entered in brackets in the table. The uncertainty in the relative values may be large.

Levels from the $3d$ configurations with limits ${}^3P$ and ${}^1D$ in Cl X are labeled X since Edlén has been unable to assign term designations to them.

The unit used by Edlén, 10^3 cm^{-1}, has here been converted to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **100**, 726 (1936).   (I P) (T) (C L)

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
$2p$ ²P₂ ²P₁	$2s^2\,2p^5$	$2p^5$ ²P°	1½ ½	0 13600	−13600	$3d$ X₂	$2s^2\,2p^4(^3P)3d$	$3d$ X₂		2209470	
$2p'$ ²S₁	$2s\,2p^6$	$2p^6$ ²S	½	[553400]		$3d$ X₁	$2s^2\,2p^4(^3P)3d$	$3d$ X₁		2216710	
$3s$ ⁴P₃ ⁴P₂ ⁴P₁	$2s^2\,2p^4(^3P)3s$	$3s$ ⁴P	2½ 1½ ½	1888970 1896600 1901850	−7630 −5250	$\overline{3d}$ X₅	$2s^2\,2p^4(^1D)3d$	$3d'$ X₅		2259280	
$3s$ ²P₂ ²P₁	$2s^2\,2p^4(^3P)3s$	$3s$ ²P	1½ ½	1911950 1921050	−9100	$\overline{3d}$ X₄	$2s^2\,2p^4(^1D)3d$	$3d'$ X₄		2263310	
$\overline{3s}$ ²D₃ ²D₂	$2s^2\,2p^4(^1D)3s$	$3s'$ ²D	2½ 1½	1959790 1959960	−170	$\overline{3d}$ X₂,₃	$2s^2\,2p^4(^1D)3d$	$3d'$ X₂,₃		2268000	
$\overline{\overline{3s}}$ ²S₁	$2s^2\,2p^4(^1S)3s$	$3s''$ ²S	½	2031080		$\overline{3d}$ X₁	$2s^2\,2p^4(^1D)3d$	$3d'$ X₁		2272570	
$3d$ X₆	$2s^2\,2p^4(^3P)3d$	$3d$ X₆		2196890		$\overline{\overline{3d}}$ ²D₃ ²D₂	$2s^2\,2p^4(^1S)3d$	$3d''$ ²D	2½ 1½	2328830 2330130	−1300
$3d$ X₅	$2s^2\,2p^4(^3P)3d$	$3d$ X₅		2199540		$3s'$ ²P₂ ²P₁	$2s\,2p^5(^3P°)3s$	$3s'''$ ²P°	1½ ½	[2415740] [2424380]	−8640
$3d$ X₄	$2s^2\,2p^4(^3P)3d$	$3d$ X₄		2203850		$3d'$ ²P₁ ²P₂	$2s\,2p^5(^3P°)3d$	$3d'''$ ²P°	½ 1½	[2715940] [2722690]	6750
$3d$ X₃	$2s^2\,2p^4(^3P)3d$	$3d$ X₃		2205950		Cl x (³P₂)		*Limit*	-----	[3233000]	

March 1947.

Cl IX Observed Terms*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^5$	$2p^5$ ²P°		
$2s\,2p^6$	$2p^6$ ²S		
		$ns\ (n \geq 3)$	$nd\ (n \geq 3)$
$2s^2\,2p^4(^3P)nx$	$\Big\{$	$3s$ ⁴P $3s$ ²P	
$2s^2\,2p^4(^1D)nx'$		$3s'$ ²D	
$2s^2\,2p^4(^1S)nx''$		$3s''$ ²S	$3d''$ ²D
$2s\,2p^5(^3P°)nx'''$		$3s'''$ ²P°	$3d'''$ ²P°

*For predicted terms in the spectra of the F I isoelectronic sequence, see Introduction.

Cl x

(O I sequence; 8 electrons) $Z=17$

Ground state $1s^2\,2s^2\,2p^4\,^3P_2$

$2p^4\,^3P_2\ 3673000\ cm^{-1}$ I. P. 455.3 volts

Edlén has classified 15 lines between 39 A and 47 A. The absolute value of the ground term has been extrapolated from the isoelectronic sequence. Similarly, the singlet and triplet terms are connected only through the extrapolated value of $2p^4\,^3P_2-2p^4\,^1D_2$, and the uncertainty, x, may be large. The estimated value of $2p^5\,^3P_2^{\circ}$ is given in brackets.

Edlén's term values expressed in units of $10^3\ cm^{-1}$ are here changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit, Phys. **100**, 732 (1936). (I P) (T) (C L).

Cl x   Cl x

Edlén	Config.	Desig.	J	Level	Interval	Edlén	Config.	Desig.	J	Level	Interval
$2p\ ^3P_2$ $^3P_1$	$2s^2\,2p^4$	$2p^4\ ^3P$	2 1 0	0 10880	-10880	$\overline{\overline{3s}}\ ^1P_1$	$2s^2\,2p^3(^2P^{\circ})3s$	$3s''\ ^1P^{\circ}$	1	$2262140\ +x$	
						$3d\ ^3D_2$ $^3D_3$	$2s^2\,2p^3(^4S^{\circ})3d$	$3d\ ^3D^{\circ}$	1 2 3	2415360 2416040	680
$2p\ ^1D$	$2s^2\,2p^4$	$2p^4\ ^1D$	2	$61000\ +x$							
$2p\ ^1S$	$2s^2\,2p^4$	$2p^4\ ^1S$	0	$130310\ +x$		$\overline{3d}\ ^3D$	$2s^2\,2p^3(^2D^{\circ})3d$	$3d'\ ^3D^{\circ}$	3, 2, 1	2494700	
$2p'\ ^3P$	$2s\ 2p^5$	$2p^5\ ^3P^{\circ}$	2 1 0	[487000]		$\overline{3d}\ ^1D_2$	$2s^2\,2p^3(^2D^{\circ})3d$	$3d'\ ^1D^{\circ}$	2	$2500380\ +x$	
						$\overline{3d}\ ^3P$	$2s^2\,2p^3(^2D^{\circ})3d$	$3d'\ ^3P^{\circ}$	2, 1, 0	2502750	
$3s\ ^3S_1$	$2s^2\,2p^3(^4S^{\circ})3s$	$3s\ ^3S^{\circ}$	1	2134700		$\overline{3d}\ ^1F_3$	$2s^2\,2p^3(^2D^{\circ})3d$	$3d'\ ^1F^{\circ}$	3	$2520420\ +x$	
$\overline{3s}\ ^3D$	$2s^2\,2p^3(^2D^{\circ})3s$	$3s'\ ^3D^{\circ}$	3, 2, 1	2202610		$\overline{\overline{3d}}\ ^3D$	$2s^2\,2p^3(^2P^{\circ})3d$	$3d''\ ^3D^{\circ}$	3, 2, 1	2547580	
$\overline{3s}\ ^1D$	$2s^2\,2p^3(^2D^{\circ})3s$	$3s'\ ^1D^{\circ}$	2	$2212650\ +x$							
						Cl xi $(^4S_{1\frac{1}{2}})$		Limit		3673000	

March 1947.

Cl x Observed Terms*

Config. $1s^2+$	Observed Terms			
$2s^2\,2p^4$	$\{2p^4\ ^1S$ $2p^4\ ^3P$ $2p^4\ ^1D$			
		ns $(n\geq 3)$		*nd* $(n\geq 3)$
$2s^2\,2p^3(^4S^{\circ})nx$	$3s\ ^3S^{\circ}$			$3d\ ^3D^{\circ}$
$2s^2\,2p^3(^2D^{\circ})nx'$	$\{$	$3s'\ ^3D^{\circ}$ $3s'\ ^1D^{\circ}$	$3d'\ ^3P^{\circ}$	$3d'\ ^3D^{\circ}$ $3d'\ ^1D^{\circ}$ $3d'\ ^1F^{\circ}$
$2s^2\,2p^3(^2P^{\circ})nx''$	$\{$ $3s''\ ^1P^{\circ}$			$3d''\ ^3D^{\circ}$

*For predicted terms in the spectra of the O I isoelectronic sequence, see Introduction.

Cl XI

(N I sequence; 7 electrons) $Z=17$

Ground state $1s^2\ 2s^2\ 2p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$2p^3\ {}^4S^\circ_{1\frac{1}{2}}$ cm^{-1} I. P.   volts

This spectrum has not been analyzed, but Edlén has classified two lines as due to Cl XI:

A	Int.	Wave No.	Desig.
40. 787	0	2451760	$2p^3\ {}^2D^\circ - 3s'\ {}^2D$
40. 392	0	2475740	$2p^3\ {}^4S^\circ_{1\frac{1}{2}} - 3s\ {}^4P_{2\frac{1}{2}}$

By extrapolation along the isoelectronic sequence, he lists combinations giving the relative positions of two other levels (entered in brackets in the table). From these data preliminary term values have been calculated and entered below. The uncertainty x is probably large.

The unit used by Edlén, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **100**, 728 (1936). (C L)

Cl XI

Edlén	Config.	Desig.	J	Level
$2p\ {}^4S_2$	$2s^2\ 2p^3$	$2p^3\ {}^4S^\circ$	$1\frac{1}{2}$	*0*
$2p\ {}^2D_3$	$2s^2\ 2p^3$	$2p^3\ {}^2D^\circ$	$1\frac{1}{2}$ $2\frac{1}{2}$	*[94000]+x*
$2p\ {}^2P_2$	$2s^2\ 2p^3$	$2p^3\ {}^2P^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$	*[143000]+x*
$3s\ {}^4P_3$	$2s^2\ 2p^2({}^3P)3s$	$3s\ {}^4P$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	2475740
$\overline{3s}\ {}^2D$	$2s^2\ 2p^2({}^1D)3s$	$3s'\ {}^2D$	$\left\{\begin{array}{c}1\frac{1}{2}\\2\frac{1}{2}\end{array}\right.$	$\left.\right\}$2545760?+x

February 1947.

ARGON

18 electrons $Z=18$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,{}^1S_0$

$3p^6\ {}^1S_0\ \mathbf{127109.9}\ cm^{-1}$ I. P. 15.755 volts

The present list has been compiled from an unpublished manuscript kindly furnished by Edlén, who has made a study of this spectrum and interpreted it with the aid of present atomic theory. His term array is based on those published by Humphreys (1938) and by Meggers and Humphreys (1933), although he has revised and extended their lists. Three place entries are from interferometer measurements. The values of $4f\,[4\tfrac{1}{2}]$, $4f\,[3\tfrac{1}{2}]$, and $4f'\,[3\tfrac{1}{2}]$ are from unpublished data by Humphreys based on observations by Sittner.

The terms $ns'[\tfrac{1}{2}]^\circ$ ($n=11$ to 16) and $nd'[1\tfrac{1}{2}]^\circ$ ($n=9$ to 14) have been calculated by the writer from the absorption series observed by Beutler in the region between 871 and 876 A, and added to Edlén's list. Beutler lists these terms as blended.

Edlén has determined the new values of the series limits quoted here.

The Paschen notation used by Meissner, Rasmussen, Meggers, Humphreys, and others is entered in column one of the table in the same form as for Ne I. The letters U, V, W, X, Y, Z, adopted when configurations involving f electrons were found, are also entered in this column. Twenty-seven of these levels have J-values fixed by the observed combinations. These J-values are given in italics in the table.

Edlén suggested that a pair-coupling notation be adopted for Ne-like spectra to take into account the departure from LS-coupling. According to Shortley, LS-designations can be significantly assigned in only a few cases, in particular, for the following groups of levels:

Paschen	Desig.	Paschen	Desig.	Paschen	Desig.	Paschen	Desig.	Paschen	Desig.
$(n-3)s_5$	$ns\ {}^3P_2^\circ$	$2p_{10}$	$4p\ {}^3S_1$	$2p_5$	$4p\ {}^3P_0$	$4d_6$	$4d\ {}^3P_0^\circ$	$4d_1''$	$4d\ {}^3F_2$
$(n-3)s_4$	$ns\ {}^3P_1^\circ$	$2p_9$	$4p\ {}^3D_3$	$2p_4$	$4p\ {}^1P_1$	$4d_5$	$4d\ {}^3P_1^\circ$	$4d_1'$	$4d\ {}^1F_3$
$(n-3)s_3$	$ns\ {}^3P_0^\circ$	$2p_8$	$4p\ {}^3D_2$	$2p_3$	$4p\ {}^3P_2$	$4d_4'$	$4d\ {}^3F_4^\circ$	$4s_1''''$	$4d\ {}^1D_2^\circ$
$(n-3)s_2$	$ns\ {}^1P_1^\circ$	$2p_7$	$4p\ {}^3D_1$	$2p_2$	$4p\ {}^3P_1$	$4d_4$	$4d\ {}^3F_3^\circ$	$4s_1'''$	$4d\ {}^3D_3^\circ$
		$2p_6$	$4p\ {}^1D_2$	$2p_1$	$4p\ {}^1S_0$	$4d_3$	$4d\ {}^3P_2^\circ$	$4s_1''$	$4d\ {}^3D_2^\circ$
						$4d_2$	$4d\ {}^1P_1^\circ$	$4s_1'$	$4d\ {}^3D_1^\circ$

Consequently, the jl-coupling notation in the general form suggested by Racah is here introduced. The present arrangement has been suggested by Shortley, who has made a detailed investigation of the theoretical arrangement of the "pairs", to be used as a guide in preparing the present table. The pairs $nd\,[3\tfrac{1}{2}]^\circ$ and $nd[1\tfrac{1}{2}]^\circ$ are partially inverted as compared with Ne I.

No Grotrian diagram appears to have been published for this spectrum.

A I—Continued

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B. Edlén, unpublished material (April 1948).   (I P) (T) (C L)

W. R. Sittner, unpublished material (1949).

A I

Authors	Config.	Desig.	J	Level	Obs. g	Authors	Config.	Desig.	J	Level	Obs. g
$1p_0$	$3p^6$	$3p^6\,^1S$	0	0.0		$3p_{10}$	$3p^5(^2P^\circ_{1\frac12})5p$	$5p\ [\tfrac12]$	1	116660.054	1.90
						$3p_9$	"	$5p\ [2\tfrac12]$	3	116942.815	
$1s_5$	$3p^5(^2P^\circ_{1\frac12})4s$	$4s\ [1\tfrac12]^\circ$	2	93143.800	1.506	$3p_8$			2	116999.389	1.09
$1s_4$			1	93750.639	1.404	$3p_7$	"	$5p\ [1\tfrac12]$	1	117151.387	1.01
$1s_3$	$3p^5(^2P^\circ_{\frac12})4s$	$4s'\ [\tfrac12]^\circ$	0	94553.707		$3p_6$			2	117183.654	1.42
$1s_2$			1	95399.870	1.102	$3p_5$	"	$5p\ [\tfrac12]$	0	117563.020	
$2p_{10}$	$3p^5(^2P^\circ_{1\frac12})4p$	$4p\ [\tfrac12]$	1	104102.144	1.985	$3p_4$	$3p^5(^2P^\circ_{\frac12})5p$	$5p'\ [1\tfrac12]$	1	118407.494	0.61
$2p_9$	"	$4p\ [2\tfrac12]$	3	105462.804	1.338	$3p_3$			2	118469.117	1.18
$2p_8$			2	105617.315	1.112	$3p_2$	"	$5p'\ [\tfrac12]$	1	118459.662	1.45
$2p_7$	"	$4p\ [1\tfrac12]$	1	106087.305	0.838	$3p_1$			0	118870.981	
$2p_6$			2	106237.597	1.305	$4d_6$	$3p^5(^2P^\circ_{1\frac12})4d$	$4d\ [\tfrac12]^\circ$	0	118512.17	
$2p_5$	"	$4p\ [\tfrac12]$	0	107054.319		$4d_5$			1	118651.447	1.467
$2p_4$	$3p^5(^2P^\circ_{\frac12})4p$	$4p'\ [1\tfrac12]$	1	107131.755	0.819	$4d'_4$	"	$4d\ [3\tfrac12]^\circ$	4	119023.699	1.255
$2p_3$			2	107289.747	1.260	$4d_4$			3	119212.93	1.077
$2p_2$	"	$4p'\ [\tfrac12]$	1	107496.463	1.380	$4d_3$	"	$4d\ [1\tfrac12]^\circ$	2	118906.665	1.437
$2p_1$			0	108722.668		$4d_2$			1	119847.81	0.768
$3d_6$	$3p^5(^2P^\circ_{1\frac12})3d$	$3d\ [\tfrac12]^\circ$	0	111667.87		$4d''_1$	"	$4d\ [2\tfrac12]^\circ$	2	119444.88	0.908
$3d_5$			1	111818.09		$4d'_1$			3	119566.11	
$3d'_4$	"	$3d\ [3\tfrac12]^\circ$	4	112750.22		$4s''''_1$	$3p^5(^2P^\circ_{\frac12})4d$	$4d'\ [2\tfrac12]^\circ$	2	120619.076	0.987
$3d_4$			3	113020.39		$4s'''_1$			3	120753.52	1.133
$3d_3$	"	$3d\ [1\tfrac12]^\circ$	2	112138.98		$4s''_1$	"	$4d'\ [1\tfrac12]^\circ$	2	120600.944	1.057
$3d_2$			1	114147.75		$4s'_1$			1	121011.979	0.877
$3d''_1$	"	$3d\ [2\tfrac12]^\circ$	2	113426.05		$3s_5$	$3p^5(^2P^\circ_{1\frac12})6s$	$6s\ [1\tfrac12]^\circ$	2	119683.113	1.500
$3d'_1$			3	113716.61		$3s_4$			1	119760.22	1.184
$3s''''_1$	$3p^5(^2P^\circ_{\frac12})3d$	$3d'\ [2\tfrac12]^\circ$	2	114641.04		$3s_3$	$3p^5(^2P^\circ_{\frac12})6s$	$6s'\ [\tfrac12]^\circ$	0	121096.67	
$3s'''_1$			3	114821.99		$3s_2$			1	121161.356	1.271
$3s''_1$	"	$3d'\ [1\tfrac12]^\circ$	2	114805.18							
$3s_1$			1	115366.90		$4X$	$3p^5(^2P^\circ_{1\frac12})4f$	$4f\ [1\tfrac12]$	1	120188.34	
						$4X$			2	120188.66	
$2s_5$	$3p^5(^2P^\circ_{1\frac12})5s$	$5s\ [1\tfrac12]^\circ$	2	113468.55		$4V$	"	$4f\ [4\tfrac12]$	5	120207.32	
$2s_4$			1	113643.26					4	120207.77	
$2s_3$	$3p^5(^2P^\circ_{\frac12})5s$	$5s'\ [\tfrac12]^\circ$	0	114861.67		$4Y$	"	$4f\ [2\tfrac12]$	3	120229.81	
$2s_2$			1	114975.07		$4Y$			2	120230.07	

A I—Continued

Authors	Config.	Desig.	J	Level	Obs. g
4U	$3p^5(^2P^o_{1\frac12})4f$	$4f$ [3½]	3, 4	120250. 15	
4W	$3p^5(^2P^o_{\frac12})4f$	$4f'$ [3½]	3, 4	121653. 40	
4Z	"	$4f'$ [2½]	3	121654. 32	
4Z			2	121654. 58	
$4p_{10}$	$3p^5(^2P^o_{1\frac12})6p$	$6p$ [½]	1	121068. 804	
$4p_9$	"	$6p$ [2½]	3	121165. 431	
$4p_8$			2	121191. 92	
$4p_7$	"	$6p$ [1½]	1	121257. 227	
$4p_6$			2	121270. 682	
$4p_5$	"	$6p$ [½]	0	121470. 304	
$4p_4$	$3p^5(^2P^o_{\frac12})6p$	$6p'$ [1½]	1	122609. 76	
$4p_3$			2	122635. 128	
$4p_2$	"	$6p'$ [½]	1	122601. 290	
$4p_1$			0	122790. 612	
$5d_6$	$3p^5(^2P^o_{1\frac12})5d$	$5d$ [½]°	0	121794. 158	
$5d_5$			1	121932. 908	1. 400
$5d_4'$	"	$5d$ [3½]°	4	122036. 134	1. 253
$5d_4$			3	122160. 22	1. 076
$5d_3$	"	$5d$ [1½]°	2	122086. 974	1. 387
$5d_2$			1	122514. 29	0. 813
$5d_1''$	"	$5d$ [2½]°	2	122282. 134	0. 941
$5d_1'$			3	122329. 72	1. 199
$5s_1''''$	$3p^5(^2P^o_{\frac12})5d$	$5d'$ [2½]°	2	123505. 536	0. 802
$5s_1'''$			3	123557. 459	1. 127
$5s_1''$	"	$5d'$ [1½]°	2	123372. 987	1. 265
$5s_1'$			1	123815. 53	0. 846
$4s_5$	$3p^5(^2P^o_{1\frac12})7s$	$7s$ [1½]°	2	122440. 109	1. 506
$4s_4$			1	122479. 459	1. 164
$4s_3$	$3p^5(^2P^o_{\frac12})7s$	$7s'$ [½]°	0	123873. 07	
$4s_2$			1	123882. 30	1. 296
5X	$3p^5(^2P^o_{1\frac12})5f$	$5f$ [1½]	1	122686. 20	
5X			2	122686. 40	
5V	"	$5f$ [4½]	4, 5	122695. 70	
5Y	"	$5f$ [2½]	3	122707. 94	
5Y			2	122708. 18	
5U	"	$5f$ [3½]	3, 4	122717. 90	
5W	$3p^5(^2P^o_{\frac12})5f$	$5f'$ [3½]	3, 4	124135. 74	
5Z	"	$5f'$ [2½]	3	124137. 29	
5Z			2	124137. 45	
$5p_{10}$	$3p^5(^2P^o_{1\frac12})7p$	$7p$ [½]	1	123172. 09	
$5p_9$	"	$7p$ [2½]	3	123205. 83	
$5p_8$			2	123220. 73	
$5p_7$	"	$7p$ [1½]	1	123254. 99	
$5p_6$			2	123261. 593	
$5p_5$	"	$7p$ [½]	0	123385. 13	
$5p_4$	$3p^5(^2P^o_{\frac12})7p$	$7p'$ [1½]	1	124643. 54	
$5p_3$			2	124658. 52	

A I—Continued

Authors	Config.	Desig.	J	Level	Obs. g
$5p_2$	$3p^5(^2P^o_{\frac12})7p$	$7p'$ [½]	1	124651. 05	
$5p_1$			0	124749. 89	
$6d_6$	$3p^5(^2P^o_{1\frac12})6d$	$6d$ [½]°	0	123508. 96	
$6d_5$			1	123468. 034	1. 233
$6d_4'$	"	$6d$ [3½]°	4	123653. 238	1. 256
$6d_4$			3	123773. 920	1. 052
$6d_3$	"	$6d$ [1½]°	2	123808. 60	1. 206
			1		
$6d_1''$	"	$6d$ [2½]°	2	123826. 85	1. 107
$6d_1'$			3	123832. 50	1. 245
$6s_1''''$	$3p^5(^2P^o_{\frac12})6d$	$6d'$ [2½]°	2	125113. 48	0. 777
$6s_1'''$			3	125150. 00	1. 098
$6s_1''$	"	$6d'$ [1½]°	2	125066. 501	1. 264
$6s_1'$			1	125236. 28	
$5s_5$	$3p^5(^2P^o_{1\frac12})8s$	$8s$ [1½]°	2	123903. 295	1. 50
$5s_4$			1	123935. 97	
$5s_3$	$3p^5(^2P^o_{\frac12})8s$	$8s'$ [½]°	0	125334. 75	
$5s_2$			1	125353. 31	1. 26
6X	$3p^5(^2P^o_{1\frac12})6f$	$6f$ [1½]	1	124041. 20	
6X			2	124041. 38	
6V	"	$6f$ [4½]	4, 5	124046. 64	
6Y	"	$6f$ [2½]	3	124051. 44	
6Y			2	124051. 65	
6U	"	$6f$ [3½]	3, 4	124058. 36	
6W	$3p^5(^2P^o_{\frac12})6f$	$6f'$ [3½]	3, 4	125482. 70	
6Z	"	$6f'$ [2½]	3	125483. 16	
6Z			2	125483. 34	
$6p_{10}$	$3p^5(^2P^o_{1\frac12})8p$	$8p$ [½]	1	124311. 72	
$6p_9$	"	$8p$ [2½]	3	124349. 04	
$6p_8$			2	124356. 73	
$6p_7$	"	$8p$ [1½]	1	124376. 38	
$6p_6$			2	124381. 01	
$6p_5$	"	$8p$ [½]	0	124439. 41	
$6p_4$	$3p^5(^2P^o_{\frac12})8p$	$8p'$ [1½]	1	125783. 8	
$6p_3$			2	125791. 94	
$6p_2$	"	$8p'$ [½]	1	125777. 3	
$6p_1$			0	125831. 45	
$7d_6$	$3p^5(^2P^o_{1\frac12})7d$	$7d$ [½]°	0	124526. 75	
$7d_5$			1	124554. 939	
$7d_4'$	"	$7d$ [3½]°	4	124609. 917	
$7d_4$			3	124649. 549	
$7d_3$	"	$7d$ [1½]°	2	124603. 957	
$7d_2$			1	124788. 39	
$7d_1''$	"	$7d$ [2½]°	2	124692. 02	
$7d_1'$			3	124715. 16	
$7s_1''''$	$3p^5(^2P^o_{\frac12})7d$	$7d'$ [2½]°	2	126064. 50	
$7s_1'''$			3	126089. 56	

Authors	Config.	Desig.	J	Level	Obs. g
$7s_1''$	$3p^5(^2P^\circ_{\frac12})7d$	$7d'$ [1½]°	2	126053.21	
			1		
$6s_5$	$3p^5(^2P^\circ_{1\frac12})9s$	$9s$ [1½]°	2	124771.67	
$6s_4$			1	124782.77	
$6s_3$	$3p^5(^2P^\circ_{\frac12})9s$	$9s'$ [½]°	0	126202.82	
$6s_2$			1	126211.57	
$7X$	$3p^5(^2P^\circ_{1\frac12})7f$	$7f$ [1½]	1	124857.27	
$7X$			2	124857.42	
$7V$	''	$7f$ [4½]	4, 5	124860.64	
$7Y$	''	$7f$ [2½]	3	124865.04	
$7Y$			2	124865.19	
$7U$	''	$7f$ [3½]	3, 4	124868.77	
$7W$	$3p^5(^2P^\circ_{\frac12})7f$	$7f'$ [3½]	3, 4	126294.90	
$7Z$	''	$7f'$ [2½]	3	126295.02	
			2		
$7p_{10}$	$3p^5(^2P^\circ_{1\frac12})9p$	$9p$ [½]	1	125039.60	
$7p_9$	''	$9p$ [2½]	3	125054.1	
$7p_8$			2	125059.8	
$7p_7$	''	$9p$ [1½]	1	125072.6	
$7p_6$			2	125074.9	
$7p_5$	''	$9p$ [½]	0	125122.54	
$7p_1$	$3p^5(^2P^\circ_{\frac12})9p$	$9p'$ [½]	1	126524.2	
			0		
$8d_6$	$3p^5(^2P^\circ_{1\frac12})8d$	$8d$ [½]°	0	125163.00	
$8d_5$			1	125135.898	
$8d_4'$	''	$8d$ [3½]°	4	125219.88	
$8d_4$			3	125269.52	
$8d_3$	''	$8d$ [1½]°	2	125282.97	
			1		
$8d_1''$	''	$8d$ [2½]°	2	125291.45	
$8d_1'$			3	125293.65	
$7s_5$	$3p^5(^2P^\circ_{1\frac12})10s$	$10s$ [1½]°	2	125329.99	
$7s_4$			1	125331.93	
$8X$	$3p^5(^2P^\circ_{1\frac12})8f$	$8f$ [1½]	1, 2	125386.41	
$8V$	''	$8f$ [4½]	4, 5	125388.65	
$8Y$	''	$8f$ [2½]	3	125391.04	
$8Y$			2	125391.17	
$8U$	''	$8f$ [3½]	3, 4	125393.79	
$8p_{10}$	$3p^5(^2P^\circ_{1\frac12})10p$	$10p$ [½]	1	125505.5	
$8p_9$	''	$10p$ [2½]	3	125519.9	
			2		
$8p_7$	''	$10p$ [1½]	1	125531.5	
$8p_6$			2	125533.8	
$8p_5$	''	$10p$ [½]	0	125561.9	
$9d_6$	$3p^5(^2P^\circ_{1\frac12})9d$	$9d$ [½]°	0	125595.11	
$9d_5$			1	125613.12	
$9d_4'$	$3p^5(^2P^\circ_{1\frac12})9d$	$9d$ [3½]°	4	125631.69	
$9d_4$			3	125652.04	
$9d_3$	''	$9d$ [1½]°	2	125637.93	
$9d_2$			1	125718.12	
$9d_1''$	''	$9d$ [2½]°	2	125671.53	
$9d_1'$			3	125680.52	
$9s_1'$	$3p^5(^2P^\circ_{\frac12})9d'$	$9d'$ [1½]°	2	127130	
			1		
$8s_5$	$3p^5(^2P^\circ_{1\frac12})11s$	$11s$ [1½]°	2	125709.45	
$8s_4$			1	125715.50	
	$3p^5(^2P^\circ_{\frac12})11s$	$11s'$ [½]°	0		
$8s_2$			1	127130	
$9X$	$3p^5(^2P^\circ_{1\frac12})9f$	$9f$ [1½]	1, 2	125748.9	
$9V$	''	$9f$ [4½]	4, 5	125750.39	
$9Y$	''	$9f$ [2½]	3	125752.8	
			2		
$9U$	''	$9f$ [3½]	3, 4	125754.21	
$9p_{10}$	$3p^5(^2P^\circ_{1\frac12})11p$	$11p$ [½]	1	125844.3	
$9p_7$	''	$11p$ [1½]	1	125853.3	
$9p_6$			2	125853.8	
$9p_5$	''	$11p$ [½]	0	125888.9	
$10d_6$	$3p^5(^2P^\circ_{1\frac12})10d$	$10d$ [½]°	0	125895.72	
$10d_5$			1	125898.64	
$10d_4'$	''	$10d$ [3½]°	4	125922.53	
$10d_4$			3	125932.59	
$10d_3$	''	$10d$ [1½]°	2	125906.61	
			1		
$10d_1''$	''	$10d$ [2½]°	2	125945.72	
$10d_1'$			3	125957.40	
$10s_1'$	$3p^5(^2P^\circ_{\frac12})10d$	$10d'$ [1½]°	2	127410	
			1		
$9s_5$	$3p^5(^2P^\circ_{1\frac12})12s$	$12s$ [1½]°	2	125979.41	
$9s_4$			1	125984.35	
	$3p^5(^2P^\circ_{\frac12})12s$	$12s'$ [½]°	0		
$9s_2$			1	127410	
$10p_{10}$	$3p^5(^2P^\circ_{1\frac12})12p$	$12p$ [½]	1	126072.6	
$10p_5$			0	126101.7	
$11d_6$	$3p^5(^2P^\circ_{1\frac12})11d$	$11d$ [½]°	0	126114.66	
$11d_5$			1	126099.49	
$11d_4'$	''	$11d$ [3½]°	4	126135.42	
$11d_4$			3	126154.55	
$11d_3$	''	$11d$ [1½]°	2	126159.9	
			1		
$11d_1''$	''	$11d$ [2½]°	2	126162.5	
$11d_1'$			3	126163.24	

A I—Continued

Authors	Config.	Desig.	J	Level	Obs. g
11s'₁	3p⁵(²P°_½)11d	11d' [1½]°	2		
			1	*127610*	
10s₅	3p⁵(²P°_1½)13s	13s [1½]°	2	*126178. 27*	
10s₄			1	*126181. 30*	
10s₂	3p⁵(²P°_½)13s	13s' [½]°	0		
			1	*127610*	
11p₅	3p⁵(²P°_1½)13p	13p [½]	1		
			0	126270. 0	
12d₆	3p⁵(²P°_1½)12d	12d [½]°	0	*126281. 3*	
12d₅			1	*126292. 71*	
12d'₄	"	12d [3½]°	4	*126295. 79*	
12d₄			3	*126305. 28*	
12d₃	3p⁵(²P°_1½)13d	12d [1½]°	2	*126302. 6*	
			1		
12d''₁	"	12d [2½]°	2	*126313. 1*	
12d'₁			3	*126316. 1*	
12s'₁	3p⁵(²P°_½)12d	12d' [1½]°	2		
			1	*127760*	
11s₅	3p⁵(²P°_1½)14s	14s [1½]°	2	*126328. 80*	
11s₄			1	*126332. 0*	
11s₂	3p⁵(²P°_½)14s	14s' [½]°	0		
			1	*127760*	
13d₅	3p⁵(²P°_1½)13d	13d [½]°	0		
			1	*126412. 99*	
13d'₄	"	13d [3½]°	4	*126419. 65*	
13d₄			3	*126426. 07*	

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A I—Continued

Authors	Config.	Desig.	J	Level	Obs. g
13d₃	3p⁵(²P°_1½)13d	13d [1½]°	2	*126420. 8*	
			1		
13d''₁	"	13d [2½]°	2	*126432. 1*	
13d'₁			3	*126435. 5*	
13s'₁	3p⁵(²P°_½)13d	13d' [1½]°	2		
			1	*127880*	
14d₆	3p⁵(²P°_1½)14d	14d [½]°	0	*126508. 1*	
14d₅			1	*126510. 06*	
14d'₄	"	14d [3½]°	4	*126517. 41*	
14d₄			3	*126521. 71*	
14d₃	"	14d [1½]°	2	*126514. 8*	
			1		
14d'₁	"	14d [2½]°	2		
			3	*126530. 1*	
14s'₁	3p⁵(²P°_½)14d	14d' [1½]°	2		
			1	*127970*	
	A II (²P°_1½)	Limit	-----	**127109. 9**	
12s₂	3p⁵(²P°_½)15s	15s' [½]°	0		
			1	*127880*	
13s₂	3p⁵(²P°_½)16s	16s' [½]°	0		
			1	*127970*	
	A II (²P°_½)	Limit	-----	**128541. 3**	

A I Observed Levels*

Config. 1s² 2s² 2p⁶ 3s²+	Observed Terms			
3p⁶	3p⁶ ¹S			
	ns (n≥4)	np (n≥4)	nd (n≥3)	
3p⁵(²P°)nx	{ 4–16s ³P° 4–9, 11–16s ¹P°	4p ³S 4p ³P 4p ³D 4p ¹S 4p ¹P 4p ¹D	4d ³P° 4d ³D° 4d ³F° 4d ¹P° 4d ¹D° 4d ¹F°	

jl-Coupling Notation

	Observed Pairs			
	ns (n≥4)	np (n≥4)	nd (n≥3)	nf (n≥4)
3p⁵(²P°_1½)nx	4–14s [1½]°	4–13p [½] 4–10p [2½] 4–11p [1½]	3–14d [½]° 3–14d [3½]° 3–14d [1½]° 3–14d [2½]°	4–9f [1½] 5–9f [4½] 4–9f [2½] 5–9f [3½]
3p⁵(²P°_½)nx'	4–9, 11–16s' [½]°	4–8p'[1½] 4–9p' [½]	3– 7d'[2½]° 3–7, 9–14d'[1½]°	4–7f'[3½] 4–7f'[2½]

*For predicted levels in the spectra of the A I isoelectronic sequence, see Introduction.

(Cl I sequence; 17 electrons) $Z=18$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^5\,{}^2\mathrm{P}^\circ_{1\frac{1}{2}}$

$3p^5\,{}^2\mathrm{P}^\circ_{1\frac{1}{2}}\ 222820\pm300$ cm^{-1} I. P. 27.62 volts

A monograph containing the complete and detailed analysis of this spectrum is needed. Most of the analysis is by de Bruin, but his work has been revised and extended by a number of investigators who are not in complete agreement on all details of interpretation.

The term list published by Boyce forms the basis of the present compilation, but the later additions and revisions by Minnhagen, Edlén, and de Bruin have been incorporated into the present list. The writer has prepared a complete multiplet array for this spectrum and in dubious cases she has attempted to adopt the term assignments that appear to be best confirmed from the multiplet evidence.

One term labeled "^{2}P" in the table, ("$a\ ^2$P" in the published papers), has as yet no configuration assignment. Three miscellaneous levels assigned by de Bruin (1937) to the $4f$ configuration have been omitted pending further confirmation.

The doublet and quartet terms are well connected by observed intersystem combinations. Edlén has derived the series limit quoted here from the $(^3\mathrm{P})ns\ ^4\mathrm{P}\ ^2\mathrm{P}$ series ($n=4, 5, 6$).

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A II   **A II**

Config.	Desig.	J	Level	Interval	Obs. g	Config.	Desig.	J	Level	Interval	Obs. g
$3s^2\,3p^5$	$3p^5\ ^2\mathrm{P}^\circ$	$1\frac{1}{2}$	*0. 0*	$-1432.\,0$		$3s^2\,3p^4(^1\mathrm{D})4s$	$4s'\ ^2\mathrm{D}$	$1\frac{1}{2}$	148620. 98	222. 31	0. 803
		$\frac{1}{2}$	*1432. 0*					$2\frac{1}{2}$	148843. 29		1. 202
$3s\ 3p^6$	$3p^6\ ^2\mathrm{S}$	$\frac{1}{2}$	108722. 5			$3s^2\,3p^4(^3\mathrm{P})3d$	$3d\ \ ^2\mathrm{F}$	$3\frac{1}{2}$	149180. 18	$-968.\,36$	
$3s^2\,3p^4(^3\mathrm{P})3d$	$3d\ \ ^4\mathrm{D}$	$3\frac{1}{2}$	132328. 22	$-153.\,90$				$2\frac{1}{2}$	150148. 54		
		$2\frac{1}{2}$	132482. 12	$-149.\,52$		$3s^2\,3p^4(^3\mathrm{P})3d$	$3d\ \ ^2\mathrm{D}$	$1\frac{1}{2}$	150475. 82	612. 36	
		$1\frac{1}{2}$	132631. 64	$-106.\,96$				$2\frac{1}{2}$	151088. 18		
		$\frac{1}{2}$	132738. 60			$3s^2\,3p^4(^3\mathrm{P})4p$	$4p\ \ ^4\mathrm{P}^\circ$	$2\frac{1}{2}$	*155044. 07*	$-307.\,97$	1. 599
$3s^2\,3p^4(^3\mathrm{P})4s$	$4s\ \ ^4\mathrm{P}$	$2\frac{1}{2}$	134242. 62	$-844.\,26$	1. 598			$1\frac{1}{2}$	*155352. 04*	$-356.\,98$	1. 720
		$1\frac{1}{2}$	135086. 88	$-515.\,74$	1. 722			$\frac{1}{2}$	*155709. 02*		2. 638
		$\frac{1}{2}$	135602. 62		2. 650	$3s^2\,3p^4(^3\mathrm{P})4p$	$4p\ \ ^4\mathrm{D}^\circ$	$3\frac{1}{2}$	*157234. 93*	$-439.\,37$	1. 427
$3s^2\,3p^4(^3\mathrm{P})4s$	$4s\ \ ^2\mathrm{P}$	$1\frac{1}{2}$	138244. 51	$-1014.\,71$	1. 334			$2\frac{1}{2}$	*157674. 30*	$-494.\,41$	1. 334
		$\frac{1}{2}$	139259. 22		0. 676			$1\frac{1}{2}$	*158168. 71*	$-260.\,34$	1. 199
$3s^2\,3p^4(^3\mathrm{P})3d$	$3d\ \ ^4\mathrm{F}$	$4\frac{1}{2}$	142187. 42	$-530.\,59$				$\frac{1}{2}$	*158429. 05*		0. 000
		$3\frac{1}{2}$	142718. 01	$-390.\,62$		$3s^2\,3p^4(^3\mathrm{P})4p$	$4p\ \ ^2\mathrm{D}^\circ$	$2\frac{1}{2}$	*158731. 20*	$-663.\,12$	1. 241
		$2\frac{1}{2}$	143108. 63	$-263.\,85$				$1\frac{1}{2}$	*159394. 32*		0. 918
		$1\frac{1}{2}$	143372. 48			$3s^2\,3p^4(^3\mathrm{P})4p$	$4p\ \ ^2\mathrm{P}^\circ$	$\frac{1}{2}$	*159707. 46*	532. 89	0. 983
$3s^2\,3p^4(^3\mathrm{P})3d$	$3d\ \ ^2\mathrm{P}$	$\frac{1}{2}$	144710. 90	958. 94				$1\frac{1}{2}$	*160240. 35*		1. 244
		$1\frac{1}{2}$	145669. 84			$3s^2\,3p^4(^3\mathrm{P})4p$	$4p\ \ ^4\mathrm{S}^\circ$	$1\frac{1}{2}$	*161049. 65*		1. 987
$3s^2\,3p^4(^3\mathrm{P})3d$	$3d\ \ ^4\mathrm{P}$	$\frac{1}{2}$	147229. 17	274. 95		$3s^2\,3p^4(^3\mathrm{P})4p$	$4p\ \ ^2\mathrm{S}^\circ$	$\frac{1}{2}$	*161090. 31*		1. 695
		$1\frac{1}{2}$	147504. 12	372. 86							
		$2\frac{1}{2}$	147876. 98								

Config.	Desig.	J	Level	Interval	Obs. g
3s² 3p⁴(¹S)4s	4s'' ²S	½	167308.66		1.993
3s² 3p⁴(¹D)4p	4p' ²F°	2½	170401.88	129.41	0.857
		3½	170531.29		1.140
3s² 3p⁴(¹D)4p	4p' ²P°	1½	172214.74	−602.40	1.332
		½	172817.14		0.677
3s² 3p⁴(¹D)3d	3d' ²D	2½	172336.47	−494.16	
		1½	172830.63		
3s² 3p⁴(¹D)4p	4p' ²D°	1½	173348.78	45.55	0.804
		2½	173394.33		1.202
3s² 3p⁴(¹D)3d	3d' ²P	1½	174410.74	−411.20	
		½	174821.94?		
	²P	1½	179593.09	−339.74	
		½	179932.83		
3s² 3p⁴(³P)5s	5s ⁴P	2½	181595.04	−628.02	1.603
		1½	182223.06	−729.08	1.609
		½	182952.14		2.550
3s² 3p⁴(³P)5s	5s ²P	1½	183091.83	−823.75	1.445
		½	183915.58		0.816
3s² 3p⁴(³P)4d	4d ⁴D	3½	183676.42	−121.80	1.427
		2½	183798.22	−188.61	1.370
		1½	183986.83	−206.29	1.198
		½	184193.12		0.380
3s² 3p⁴(¹D)3d	3d' ²S	½	184094.10		
3s² 3p⁴(³P)4d	4d ⁴F	4½	185093.92	−531.55	1.330
		3½	185625.47	−449.59	1.217
		2½	186075.06	−266.33	1.045
		1½	186341.39		0.612
3s² 3p⁴(³P)4d	4d ⁴P	½	186172.32	299.00	2.600
		1½	186471.32	420.60	1.494
		2½	186891.92		1.588
3s² 3p⁴(¹S)3d	3d'' ²D	2½	186728.28	−22.50	
		1½	186750.78		
3s² 3p⁴(³P)4d	4d ²F	3½	186817.12	−772.50	1.167
		2½	187589.62		0.861
3s² 3p⁴(³P)4d	4d ²P	½	189935.62	658.00	0.667
		1½	190593.62		1.322
3s² 3p⁴(³P)5p	5p ²P°	1½	190106.84	−89.96	
		½	190196.80		
3s² 3p⁴(³P)5p	5p ²D°	2½			
		1½	190508.00		
3s² 3p⁴(³P)5p	5p ²S°	½	191708.46		
3s² 3p⁴(¹S)4p	4p'' ²P°	1½	191975.16	−358.93	1.332
		½	192334.09		0.760
3s² 3p⁴(³P)4d	4d ²D	2½	192557.77	−155.16	1.198
		1½	192712.93		0.833
3s² 3p⁴(³P)4f	4f ⁴F°	4½	194800.97	−21.98	
		3½	194822.95	−39.36	
		2½	194862.31	−135.34	
		1½	194997.65		
3s² 3p⁴(³P)4f	4f ⁴D°	3½	194883.96	−148.17	
		2½	195032.13	−266.49	
		1½	195298.62	16.12	
		½	195282.50		
3s² 3p⁴(¹D)5s	5s' ²D	2½	195865.61	−2.12	
		1½	195867.73		
3s² 3p⁴(³P)4f	4f 1°	1½	196077.40		
3s² 3p⁴(³P)4f	4f 2°	½	196091.04		
3s² 3p⁴(³P)4f	4f ²D°	1½	196622.78	11.15	
		2½	196633.93		
3s² 3p⁴(¹D)4d	4d' ²G	3½	198595.91	8.87	
		4½	198604.78		
3s² 3p⁴(³P)6s	6s ⁴P	2½	198813.17	−325.75	
		1½	199138.92	−972.24	
		½	200111.16		
3s² 3p⁴(¹D)4d	4d' ²P	½	199447.56	535.40	0.670
		1½	199982.96		
3s² 3p⁴(¹D)4d	4d' ²D	1½	199525.96	154.62	
		2½	199680.58		1.196
3s² 3p⁴(³P)6s	6s ²P	1½	200032.65	−591.35	
		½	200624.00		
3s² 3p⁴(¹D)4d	4d' ²F	3½	200139.84	−95.86	
		2½	200235.70		0.862
3s² 3p⁴(³P)5d	5d ²P	1½	204418.50	−97.31	
		½	204515.81		
3s² 3p⁴(³P)5d	5d ²D	2½	204586.40		
		1½			
3s² 3p⁴(¹D)4d	4d' ²S	½	205243.96		2.004
3s² 3p⁴(¹D)4f	4f' ²P°	1½	208592.90		
		½			
3s² 3p⁴(¹D)6s	6s' ²D	1½	212932.88	1.42	
		2½	212934.30		
A III (³P₂)	Limit		222820		

April 1948.

Config. $1s^2\ 2s^2\ 2p^6$	Observed Terms							
$3s^2\ 3p^5$	$3p^5\ {}^2\text{P}°$							
$3s\ 3p^6$	$3p^6\ {}^2\text{S}$							
	$ns\ (n \geq 4)$				$np\ (n \geq 4)$			
$3s^2\ 3p^4({}^3\text{P})nx$	4–6s ^{4}P 4–6s ^{2}P				4p ^{4}S° 4, 5p ^{2}S°	4p ^{4}P° 4, 5p ^{2}P°	4p ^{4}D° 4, 5p ^{2}D°	
$3s^2\ 3p^4({}^1\text{D})nx'$	4–6s′ ^{2}D				4p′ ^{2}P°	4p′ ^{2}D°	4p′ ^{2}F°	
$3s^2\ 3p^4({}^1\text{S})nx''$	4s″ ^{2}S				4p″ ^{2}P°			
	$nd\ (n \geq 3)$				$nf\ (n \geq 4)$			
$3s^2\ 3p^4({}^3\text{P})nx$	3, 4d ^{4}P 3–5d ^{2}P	3, 4d ^{4}D 3–5d ^{2}D	3, 4d ^{4}F 3, 4d ^{2}F		4f ^{4}D° 4f ^{2}D°	4f ^{4}F°		
$3s^2\ 3p^4({}^1\text{D})nx'$	3, 4d′ ^{2}S	3, 4d′ ^{2}P	3, 4d′ ^{2}D	4d′ ^{2}F	4d′ ^{2}G	4f′ ^{2}P°		
$3s^2\ 3p^4({}^1\text{S})nx''$	3d″ ^{2}D							

*For predicted terms in the spectra of the Cl I isoelectronic sequence, see Introduction.

A III

(S I sequence; 16 electrons) $\hspace{4cm}$ $Z=18$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4\ {}^3\text{P}_2$

$3p^4\ {}^3\text{P}_2$ **329965.80** cm^{-1} $\hspace{4cm}$ I. P. 40.90 volts

The terms are from de Bruin's 1937 paper except for singlets which are from Boyce and Edlén. The $3p^4\ {}^1$S term, according to Edlén, is derived from the nebular line at 5191.4 A, identified as the forbidden transition $3p^4\ {}^1$D$-3p^4\ {}^1$S.

Intersystem combinations connecting the three systems of terms have been observed.

Unfortunately, no complete or homogeneous list of classified lines exists. Such a list is needed to improve the present term values and to explain the numerical discrepancies in the various published papers. De Bruin's terms here designated $3d'\ {}^3$P°, $4d''\ {}^3$P° D° F°, and $5s''\ {}^3$P° are apparently based on unpublished observational material.

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Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^4$	$3p^4$ ^{3}P	2	0. 00		$3s^2\,3p^3(^2D^\circ)4p$	$4p'$ ^{3}P	2	231341. 80	
		1	1112. 40	$-1112.\,40$			1	231627. 30	$-285.\,50$
		0	1570. 20	$-457.\,80$			0	231754. 80	$-127.\,50$
$3s^2\,3p^4$	$3p^4$ ^{1}D	2	14010		$3s^2\,3p^3(^2P^\circ)4p$	$4p''$ ^{3}S	1	239193. 48	
$3s^2\,3p^4$	$3p^4$ ^{1}S	0	33267		$3s^2\,3p^3(^2P^\circ)4p$	$4p''$ ^{3}D	1	240150. 66	
$3s\;3p^5$	$3p^5$ ^{3}P$^\circ$	2	*113800. 70*				2	240257. 59	106. 93
		1	*114797. 60*	$-996.\,90$			3	240291. 66	34. 07
		0	*115328. 40*	$-530.\,80$	$3s^2\,3p^3(^2P^\circ)4p$	$4p''$ ^{3}P	0	242923. 96	
$3s\;3p^5$	$3p^5$ ^{1}P$^\circ$	1	*144023*				1	243145. 76	221. 80
$3s^2\,3p^3(^4S^\circ)3d$	$3d$ ^{5}D$^\circ$	0					2	243424. 97	279. 21
		1	*144882. 93*		$3s^2\,3p^3(^4S^\circ)4d$	$4d$ ^{5}D$^\circ$	0		
		2	*144885. 97*	3. 04			1	*246029. 76*	
		3	*144892. 95*	6. 98			2	*246033. 79*	4. 03
		4	*144907. 00*	14. 05			3	*246036. 64*	2. 85
$3s^2\,3p^3(^4S^\circ)3d$	$3d$ ^{3}D$^\circ$	3	*156917. 62*				4	*246046. 57*	9. 93
		2	*156924. 68*	$-7.\,06$	$3s^2\,3p^3(^4S^\circ)5s$	$5s$ ^{5}S$^\circ$	2	*250712. 27*	
		1	*157031. 40*	$-106.\,72$	$3s^2\,3p^3(^4S^\circ)4d$	$4d$ ^{3}D$^\circ$	1	*252272. 92*	
$3s^2\,3p^3(^4S^\circ)4s$	$4s$ ^{5}S$^\circ$	2	*174375. 00*				2	*252253. 69*	$-19.\,23$
$3s^2\,3p^3(^4S^\circ)4s$	$4s$ ^{3}S$^\circ$	1	*180679. 00*				3	*252289. 02*	35. 33
$3s^2\,3p^3(^2D^\circ)3d$	$3d'$ ^{3}F$^\circ$	4	*186402. 15*		$3s^2\,3p^3(^4S^\circ)5s$	$5s$ ^{3}S$^\circ$	1	*252575. 88*	
		3	*186657. 20*	$-255.\,05$	$3s^2\,3p^3(^2D^\circ)4d$	$4d'$ ^{3}F$^\circ$	2	*266722. 80*	
		2	*186903. 05*	$-245.\,85$			3	*266877. 50*	154. 70
$3s^2\,3p^3(^2D^\circ)3d$	$3d'$ ^{3}D$^\circ$	1	*187171. 12*				4	*267071. 22*	193. 72
		2	*187823. 05*	651. 93	$3s^2\,3p^3(^2D^\circ)4d$	$4d'$ ^{3}G$^\circ$	3	*267782. 10*	
		3	*188714. 05*	891. 00			4	*267833. 20*	51. 10
$3s^2\,3p^3(^2D^\circ)3d$	$3d'$ ^{3}P$^\circ$	0					5	*267895. 82*	62. 62
		1	*188517. 32*		$3s^2\,3p^3(^2D^\circ)4d$	$4d'$ ^{3}D$^\circ$	1	*268978. 80*	
		2					2	*269012. 80*	34. 00
$3s^2\,3p^3(^2D^\circ)4s$	$4s'$ ^{3}D$^\circ$	1	*196589. 20*				3	*269000. 80*	$-12.\,00$
		2	*196613. 91*	24. 71	$3s^2\,3p^3(^2D^\circ)4d$	$4d'$ ^{3}P$^\circ$	2	*271507. 88*	
		3	*196679. 80*	65. 89			1	*271672. 08*	$-164.\,20$
$3s^2\,3p^3(^4S^\circ)4p$	$4p$ ^{5}P	1	*204563. 53*				0	*271696. 22*	$-24.\,14$
		2	*204649. 24*	85. 71	$3s^2\,3p^3(^2D^\circ)4d$	$4d'$ ^{3}S$^\circ$	1	*272068. 45*	
		3	*204797. 37*	148. 13	$3s^2\,3p^3(^2D^\circ)5s$	$5s'$ ^{3}D$^\circ$	1	*272127. 82*	
$3s^2\,3p^3(^2D^\circ)3d$	$3d'$ ^{3}S$^\circ$	1	*204727. 47*				2	*272188. 16*	60. 34
$3s^2\,3p^3(^2P^\circ)4s$	$4s''$ ^{3}P$^\circ$	2	*207233. 09*				3	*272250. 90*	62. 74
		1	*207532. 15*	$-299.\,06$	$3s^2\,3p^3(^2P^\circ)4d$	$4d''$ ^{3}F$^\circ$	2	*281461. 97*	
		0	*207673. 16*	$-141.\,01$			3	*281473. 82*	11. 85
$3s^2\,3p^3(^4S^\circ)4p$	$4p$ ^{3}P	2	*209151. 82*				4		
		1	*209127. 04*	24. 78	$3s^2\,3p^3(^2P^\circ)4d$	$4d''$ ^{3}P$^\circ$	0	*281947. 88*	
		0	*209166. 35*	$-39.\,31$			1	*282000. 26*	52. 38
$3s^2\,3p^3(^2P^\circ)3d$	$3d''$ ^{3}D$^\circ$	3	*210212. 26*				2	*282099. 14*	98. 88
		2	*211004. 85*	$-792.\,59$	$3s^2\,3p^3(^2P^\circ)4d$	$4d''$ ^{3}D$^\circ$	3	*283919. 78*	
		1	*211563. 83*	$-558.\,98$			2	*284096. 26*	$-176.\,48$
$3s^2\,3p^3(^2P^\circ)3d$	$3d''$ ^{3}P$^\circ$	2	*213950. 87*				1	*284118. 51*	$-22.\,25$
		1	*214346. 70*	$-395.\,83$	$3s^2\,3p^3(^2P^\circ)5s$	$5s''$ ^{3}P$^\circ$	0	*285831. 20*	
		0	*214568. 49*	$-221.\,79$			1	*285882. 00*	50. 80
$3s^2\,3p^3(^2D^\circ)4p$	$4p'$ ^{3}D	1	225155. 18				2	*286009. 21*	127. 21
		2	225147. 93	$-7.\,25$					
		3	225402. 59	254. 66	A IV (^{4}S$^\circ_{1\frac{1}{2}}$)	*Limit*	-------	329965. 80	
$3s^2\,3p^3(^2D^\circ)4p$	$4p'$ ^{3}F	2	226355. 96						
		3	226503. 22	147. 26					
		4	226646. 06	142. 84					

A III Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms					
$3s^2\,3p^4$	{ $3p^4$ ¹S	$3p^4$ ³P	$3p^4$ ¹D			
$3s\,3p^5$	{	$3p^5$ ³P° $3p^5$ ¹P°				

	$ns\ (n \geq 4)$				$np\ (n \geq 4)$		
$3s^2\,3p^3(^4S°)nx$	{4, 5s ⁵S° {4, 5s ³S°				4p ⁵P 4p ³P		
$3s^2\,3p^3(^2D°)nx'$		4, 5s′ ³D°			4p′ ³P	4p′ ³D	4p′ ³F
$3s^2\,3p^3(^2P°)nx''$	4, 5s″ ³P°			4p″ ³S	4p″ ³P	4p″ ³D	

	$nd\ (n \geq 3)$				
$3s^2\,3p^3(^4S°)nx$	{	3, 4d ⁵D° 3, 4d ³D°			
$3s^2\,3p^3(^2D°)nx'$	3, 4d′ ³S°	3, 4d′ ³P°	3, 4d′ ³D°	3, 4d′ ³F°	4d′ ³G°
$3s^2\,3p^3(^2P°)nx''$		3, 4d″ ³P°	3, 4d″ ³D°	4d″ ³F°	

*For predicted terms in the spectra of the S ɪ isoelectronic sequence, see Introduction.

A ɪᴠ

(P ɪ sequence; 15 electrons) $Z=18$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^3\ ^4S°_{1\frac{1}{2}}$

$3p^3\ ^4S°_{1\frac{1}{2}}$ *482400* cm⁻¹   I. P. 59.79 volts

The analysis is incomplete.   Boyce has classified 26 lines in the range between 396 A and 1197 A and listed 8 terms.

De Bruin has extended the analysis and published the term list which is quoted here. Intersystem combinations connecting the doublet and quartet terms have been observed.

The ionization potential estimated by Edlén from isoelectronic sequence data has been used to calculate the limit (entered in brackets in the table).

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A IV   **A IV**

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^3$	$3p^3\;{}^4S^\circ$	1½	0.00		$3s^2\,3p^2({}^3P)4p$	$4p\;{}^4D^\circ$	½	285960.17	
$3s^2\,3p^3$	$3p^3\;{}^2D^\circ$	1½	21090	129			1½	286228.80	268.63
		2½	21219				2½	286751.68	522.88
$3s^2\,3p^3$	$3p^3\;{}^2P^\circ$	½	34854	181			3½	287555.83	804.15
		1½	35035		$3s^2\,3p^2({}^3P)4p$	$4p\;{}^4P^\circ$	½	289125.88	
$3s\,3p^4$	$3p^4\;{}^4P$	2½	117564	−951			1½	289237.82	111.94
		1½	118515	−529			2½	289834.68	596.86
		½	119044		$3s^2\,3p^2({}^3P)4p$	$4p\;{}^2D^\circ$	1½	290256.45	1411.28
$3s\,3p^4$	$3p^4\;{}^2D$	1½	145921	79			2½	291667.73	
		2½	146000		$3s^2\,3p^2({}^3P)4p$	$4p\;{}^4S^\circ$	1½	291748.70	
$3s\,3p^4$	$3p^4\;{}^2P$	1½	166356	−1088	$3s^2\,3p^2({}^3P)4p$	$4p\;{}^2P^\circ$	½	295674.54	132.23
		½	167444				1½	295806.77	
$3p^4$	$3p^4\;{}^2S$	½	177833		$3s^2\,3p^2({}^3P)4p$	$4p\;{}^2S^\circ$	½	299563.20	
$3s^2\,3p^2({}^3P)4s$	$4s\;{}^4P$	½	250219.45	687.15	$3s^2\,3p^2({}^1D)4p$	$4p'\;{}^2F^\circ$	2½	304074.29	325.61
		1½	250906.60	1065.40			3½	304399.90	
		2½	251972.00		$3s^2\,3p^2({}^1D)4p$	$4p'\;{}^2D^\circ$	2½	306236.28	−71.97
$3s^2\,3p^2({}^3P)4s$	$4s\;{}^2P$	½	256093.29	1255.60			1½	306308.25	
		1½	257348.89						
$3s^2\,3p^2({}^1D)4s$	$4s'\;{}^2D$	2½	268151.38	−20.00	A v $({}^3P_0)$	*Limit*	------	[482400]	
		1½	268171.38						

November 1947.

<div align="center">A IV OBSERVED TERMS*</div>

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms			
$3s^2\,3p^3$	$\{3p^3\;{}^4S^\circ$ $3p^3\;{}^2P^\circ$ $3p^3\;{}^2D^\circ$			
$3s\,3p^4$	$\{3p^4\;{}^2S$ $3p^4\;{}^4P$ $3p^4\;{}^2P$ $3p^4\;{}^2D$			
	ns $(n\geq 4)$		*np* $(n\geq 4)$	
$3s^2\,3p^2({}^3P)nx$	$\{4s\;{}^4P$ $4s\;{}^2P$		$4p\;{}^4S^\circ$ $4p\;{}^4P^\circ$ $4p\;{}^4D^\circ$ $4p\;{}^2S^\circ$ $4p\;{}^2P^\circ$ $4p\;{}^2D^\circ$	
$3s^2\,3p^2({}^1D)nx'$	$4s'\;{}^2D$		$4p'\;{}^2D^\circ$ $4p'\;{}^2F^\circ$	

*For predicted terms in the spectra of the P I isoelectronic sequence, see Introduction.

A V

(Si I sequence; 14 electrons) $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ $Z=18$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^2\,{}^3P_0$

$3p^2\,{}^3P_0$ **605100** cm^{-1} $\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ I. P. 75.0 volts

The terms have been taken from the paper by Phillips and Parker. This includes the earlier work by Boyce. Thirty-six lines have been classified in the region between 336 A and 836 A. Intersystem combinations connecting the singlet and triplet terms have been observed. No quintet terms have been found.

Using the method suggested by Edlén for extrapolation along the isoelectronic sequence, the writer has estimated the value of the limit quoted above and entered in brackets in the table.

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L. W. Phillips and W. L. Parker, Phys. Rev. **60**, 301 (1941). (T) (C L)

A V $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ **A V**

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^2$	$3p^2\,{}^3P$	0	0	765	$3s^2\,3p(^2P^\circ)3d$	$3d\,{}^3P^\circ$	2	*217578*	−708
		1	765	1267			1	*218286*	−356
		2	2032				0	*218642*	
$3s^2\,3p^2$	$3p^2\,{}^1D$	2	16301		$3s^2\,3p(^2P^\circ)3d$	$3d\,{}^3D^\circ$	1	*224216*	289
$3s\,3p^3$	$3p^3\,{}^3D^\circ$	1	*121632*	46			2	*224505*	212
		2	*121678*	132			3	*224717*	
		3	*121810*		$3s^2\,3p(^2P^\circ)4s$	$4s\,{}^3P^\circ$	0	*295742*	507
$3s\,3p^3$	$3p^3\,{}^3P^\circ$	2	*141764*	−9			1	*296249*	1644
		1, 0	*141773*				2	*297893*	
$3s\,3p^3$	$3p^3\,{}^3S^\circ$	1	*191537*		$3s^2\,3p(^2P^\circ)4s$	$4s\,{}^1P^\circ$	1	*301300*	
$3s\,3p^3$	$3p^3\,{}^1P^\circ$	1	*195356*		A VI ($^2P^\circ_{1/2}$)	*Limit*		[605100]	

October 1947.

A VI

(Al I sequence; 13 electrons) $\qquad$ Z=18

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\ ^2P^\circ_{1/2}$

$3p\ ^2P^\circ_{1/2}\ \mathbf{736600}$ cm^{-1} $\qquad\qquad$ I. P. 91.3 volts

The analysis is by Phillips and Parker, who have classified 37 lines in the region between 180 A and 596 A. No intersystem combinations have been observed. They estimate that $3p^2\ ^4P_{1/2}$ is 100,000 cm^{-1} above the ground state, with an uncertainty x equal to ±1000 cm^{-1}. This value is entered in brackets in the table, and it has been added to the published values of all quartet terms.

Their limit, derived from the three members of the $3p\ ^2P^\circ - nd\ ^2D$ series is 721300 ± 300 cm^{-1} (I. P. 89.41 ± 0.04). Using the method suggested by Edlén, the writer has extrapolated the value of the limit quoted above and entered in brackets in the table. The uncertainty in this estimate is large because of the incompleteness of the isoelectronic sequence data.

REFERENCE

L. W. Phillips and W. L. Parker, Phys. Rev. **60**, 301 (1941). (I P) (T) (C L)

A VI

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$\cdot\ 3p\ ^2P^\circ$	½	0		$3s\ 3p(^3P^\circ)3d$	$3d\ ^4D^\circ$	½	$319121+x$	
		1½	2210	2210			1½	$319393+x$	272
							2½	$319615+x$	222
$3s\ 3p^2$	$3p^2\ ^4P$	½	$[100000]+x$				3½	$319747+x$	132
		1½	$100802+x$	802					
		2½	$102034+x$	1232	$3s^2(^1S)4s$	$4s\ ^2S$	½	342286	
$3s\ 3p^2$	$3p^2\ ^2S$	½	169801		$3s\ 3p(^3P^\circ)4s$	$4s\ ^4P^\circ$	½	$453954+x$	
$3s\ 3p^2$	$3p^2\ ^2P$	½	182182	1395			1½	$454716+x$	762
		1½	183577				2½	$456115+x$	1399
$3s^2(^1S)3d$	$3d\ ^2D$	1½	218592	65	$3s^2(^1S)4d$	$4d\ ^2D$	1½	454760	50
		2½	218657				2½	454810	
$3p^3$	$3p^3\ ^4S^\circ$	1½	$270356+x$		$3s^2(^1S)5d$	$5d\ ^2D$	1½	555330	225
							2½	555555	
$3s\ 3p(^3P^\circ)3d$	$3d\ ^4P^\circ$	2½	$316199+x$	-616					
		1½	$316815+x$	-483					
		½	$317298+x$		A VII ($^1S_0$)	Limit		[736600]	

September 1947.

A VI Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms			
$3s^2(^1S)3p$	$3p\ ^2P^\circ$			
$3s\ 3p^2$	$\{3p^2\ ^2S$	$3p^2\ ^4P$ $3p^2\ ^2P$		
$3p^3$	$3p^3\ ^4S^\circ$			
	$ns\ (n\geq4)$		$nd\ (n\geq3)$	
$3s^2(^1S)nx$	$4s\ ^2S$			$3\text{–}5d\ ^2D$
$3s\ 3p(^3P^\circ)nx$		$4s\ ^4P^\circ$	$3d\ ^4P^\circ$	$3d\ ^4D^\circ$

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

A VII

(Mg I sequence; 12 electrons) $Z=18$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ {}^1S_0$

$3s^2\ {}^1S_0\ 1000400\ \mathrm{cm}^{-1}$ I. P. 124.0 volts

    Phillips and Parker have classified 25 lines in the interval between 151 A and 644 A.   No intersystem combinations have been observed.

    From the D-series they derive an absolute value of $3p\ {}^3P_0^\circ$ equal to $891000\pm200\ \mathrm{cm}^{-1}$, and by extrapolation along the isoelectronic sequence estimate the absolute value of $3s^2\ {}^1S_0$ as $1005000\pm1000\ \mathrm{cm}^{-1}$.

    From later data on this sequence the writer has extrapolated these values by the method suggested by Edlén, and adopted the revised entries given in the table in brackets.

REFERENCE

L. W. Phillips and W. L. Parker, Phys. Rev. **60,** 305 (1941).   (I P) (T) (C L)

A VII   A VII

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ {}^1S$	0	0		$3s({}^2S)4p$	$4p\ {}^1P^\circ$	1	*566362*	
$3s({}^2S)3p$	$3p\ {}^3P^\circ$	0	*[113095]+x*		$3s({}^2S)4d$	$4d\ {}^3D$	1	*634584+x*	
		1	*113900 +x*	805			2	*634622+x*	38
		2	*115581 +x*	1681			3	*634697+x*	75
$3s({}^2S)3p$	$3p\ {}^1P^\circ$	1	*170720*		$3s({}^2S)4f$	$4f\ {}^3F^\circ$	2, 3, 4	*660092*	
$3p^2$	$3p^2\ {}^3P$	0	269829 +x		$3s({}^2S)5d$	$5d\ {}^3D$	1	772300+x	
		1	270770 +x	941			2	772325+x	25
		2	272554 +x	1784			3	772355+x	30
$3s({}^2S)3d$	$3d\ {}^3D$	1	324097 +x						
		2	324136 +x	39	A VIII $({}^2S_{1/2})$	*Limit*		[1000400]	
		3	324184 +x	48					
$3s({}^2S)4s$	$4s\ {}^3S$	1	514083 +x						

August 1947.

A VIII

(Na I sequence; 11 electrons) $Z=18$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s\ {}^2S_{1/2}$

$3s\ {}^2S_{1/2}\ 1157400\ \mathrm{cm}^{-1}$ I. P. 143.46 ± 0.05 volts

    Phillips and Parker classified 23 lines in the interval 120 A to 526 A.   The resonance lines calculated at 700.398 A and 713.990 A, have not been observed.   Absolute term values were derived from four members of the ^{2}D-series.

REFERENCE

L. W. Phillips and W. L. Parker, Phys. Rev. **60,** 305 (1941).   (I P) (T) (C L)

A VIII

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
3s	3s ²S	½	0		5s	5s ²S	½	812422	
3p	3p ²P°	½	140058	2718	5p	5p ²P°	½	832245	446
		1½	142776				1½	832691	
3d	3d ²D	1½	332576	151	5d	5d ²D	1½	865084	27
		2½	332727				2½	865111	
4s	4s ²S	½	575910		5f	5f ²F°	2½	875248	29
4p	4p ²P°	½	628240	997			3½	875277	
		1½	629237		6d	6d ²D	{ 1½ 2½ }	955560	
4d	4d ²D	1½	697471	77					
		2½	697548		A ɪx (¹S₀)	Limit		1157400	
4f	4f ²F°	2½	716818	34					
		3½	716852						

June 1947.

A IX

(Ne ɪ sequence; 10 electrons) $Z=18$

Ground state $1s^2\, 2s^2\, 2p^6\; {}^1S_0$

$2p^6\; {}^1S_0$ cm⁻¹   I. P. 421 volts

Two lines observed at 49.180 A and 48.730 A have been classified by Phillips and Parker as combinations with the ground term. The measurements may be in error by ±0.002 A or ±100 cm⁻¹.

As for Ne ɪ, the *jl*-coupling notation in the general form suggested by Racah is here introduced.

REFERENCES

L. W. Phillips and W. L. Parker, Phys. Rev. **60**, 306 (1941). (T) (C L)
G. Racah, Phys. Rev. **61**, 537 (L) (1942).
B. Edlén, Zeit. Astroph. **22**, 62 (1942). (I P)

A IX

Authors	Config.	Desig.	J	Level
¹S₀	2p⁶	2p⁶ ¹S	0	0
³P₁	2p⁵(²P°₁½)3s	3s [1½]°	2 1	2033350
¹P₁	2p⁵(²P°½)3s	3s′ [½]°	0 1	2052120

April 1947.

A X

(F I sequence; 9 electrons) $\qquad$ $Z=18$

Ground state $1s^2\, 2s^2\, 2p^5\ {}^2\mathrm{P}^{\circ}_{1\frac{1}{2}}$

$2p^5\ {}^2\mathrm{P}^{\circ}_{1\frac{1}{2}}$	cm^{-1}	I. P.	volts

This spectrum has not been analyzed. By interpolation along the F I isoelectronic sequence from F I through Ca XII, Edlén derives a reliable estimated value of the interval of the ground term, $2p^5\ {}^2\mathrm{P}^{\circ}_{1\frac{1}{2}}-2p^5\ {}^2\mathrm{P}^{\circ}_{\frac{1}{2}}$, equal to 18063 cm^{-1}. The faint coronal line observed at 5536 A, wave number 18059 cm^{-1}, may thus be tentatively identified as this forbidden line of A x, according to Edlén.

REFERENCE

B. Edlén, Zeit. Astroph. **22**, 59 (1942). (T)

March 1947.

A XI

(O I sequence; 8 electrons) $\qquad$ $Z=18$

Ground state $1s^2\, 2s^2\, 2p^4\ {}^3\mathrm{P}_2$

$2p^4\ {}^3\mathrm{P}_2$	cm^{-1}	I. P.	volts

This spectrum has not been analyzed. By extrapolation along the O I isoelectronic sequence Edlén estimates the separation $2p^4\ {}^3\mathrm{P}_2-2p^4\ {}^3\mathrm{P}_1$ to be approximately 14449 cm^{-1}, or 6919 A. This line has not been identified in the solar corona.

REFERENCE

B. Edlén, Zeit. Astroph. **22**, 59 (1942). (T)

March 1947.

A XIV

(B I sequence; 5 electrons) $\qquad$ $Z=18$

Ground state $1s^2\, 2s^2\, 2p\ {}^2\mathrm{P}^{\circ}_{\frac{1}{2}}$

$2p\ {}^2\mathrm{P}^{\circ}_{\frac{1}{2}}$	cm^{-1}	I. P.	volts

By extrapolation of the B I isoelectronic sequence, Edlén estimates that the separation of the lowest term $2p\ {}^2\mathrm{P}^{\circ}_{\frac{1}{2}}-2p\ {}^2\mathrm{P}^{\circ}_{1\frac{1}{2}}$, falls near enough to warrant tentative identification of the coronal line observed at 4359 A (wave number 22935 cm^{-1}) as [A XIV].

REFERENCE

B. Edlén, Zeit. Astroph. **22**, 59 (1942). (T)

March 1947.

POTASSIUM

K I

19 electrons $Z=19$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s\ ^2S_{\frac{1}{2}}$

$4s\ ^2S_{\frac{1}{2}}$ **35009.78 cm^{-1}** I. P. 4.339 volts

H. R. Kratz has observed in absorption the $np\ ^2P^\circ$ series to $n=79$. He has generously furnished a list of his final term values in advance of publication, for inclusion here. His value of the limit is quoted. The series $ns\ ^2S$ ($n=4$ to 8), $nd\ ^2D$ ($n=3$ to 6), and $nf\ ^2F^\circ$ ($n=4$ to 9) are from Edlén, who revised the older values. Edlén remarks that the $ns\ ^2S$ and $nd\ ^2D$ series can best be continued by an extrapolation of the appropriate series formula, since the observed wavelengths are uncertain. This comment applies to the listed values of $ns\ ^2S$ ($n=9$ to 13), which are from Fowler's Report. Mack has furnished revised values of $nd\ ^2D$ ($n=8$ to 13), derived from observations of the forbidden transitions $6s-nd$ on the plates of Kratz. The last two members of this series are, respectively, 34213.1 and 34332.6.

From Paschen's classifications of far infrared lines Edlén concludes that the $5g\ ^2G$ and $6h\ ^2H^\circ$ terms are H-like. The terms derived from these calculations are entered in brackets in the table. Compared with all others, the terms $4f\ ^2F^\circ$, $5f\ ^2F^\circ$, and $5s\ ^2S$, derived from far infrared observations, are somewhat uncertain, according to Edlén.

No attempt has been made to give a complete bibliography of papers dealing with hyperfine structure of K I. From interferometric measures of the combinations $4p\ ^2P^\circ-nd\ ^2D$ ($n=5$ to 8) Masaki and Kobayakawa observe the following term intervals:

	$n=5$	6	7	8
$nd\ ^2D$	−0.503	−0.262	−0.158	−0.096
$4p\ ^2P^\circ_{\frac{1}{2}}-4p\ ^2P^\circ_{1\frac{1}{2}}$	57.600	57.600	57.599	57.600

The papers on Zeeman effect deal only with forbidden transitions of K I. From observations in a magnetic field of the lines at 4642 A and 4641 A ($4s\ ^2S-3d\ ^2D$) Segrè and Bakker observe the interval of $3d\ ^2D$ to be 2.325 ± 0.015 cm^{-1}.

The K I^b resonance lines have been observed in absorption by Beutler and Guggenheimer at 662.38 A and 653.31 A. The $4s^2\ ^2P^\circ$ term in the table has been calculated from these lines.

REFERENCES

S. Datta, Proc. Roy. Soc. London [A] **101,** 539 (1922). (I P) (T) (C L)

A. Fowler, *Report on Series in Line Spectra* p. 101 (Fleetway Press, London, 1922). (I P) (T) (C L)

F. Paschen und R. Götze, *Seriengesetze der Linienspektren* p. 59 (Julius Springer, Berlin, 1922). (I P) (T) (C L)

W. Grotrian, *Graphische Darstellung der Spektren von Atomen und Ionen mit ein, zwei and drei Valenzelektronen,* Part II, p. 29 (Julius Springer, Berlin, 1928). (G D)

E. Segrè und C. J. Bakker, Zeit. Phys. **72,** 724 (1931). (Z E)

H. Beutler und K. Guggenheimer, Zeit. Phys. **87,** 188 (1933). (T) (C L)

W. F. Meggers, Bur. Std. J. Research **10,** 673, RP558 (1933). (C L)

W. F. Meggers, J. Research Nat. Bur. Std. **14,** 497, RP781 (1935). (C L)

B. Edlén, Zeit. Phys. **98,** 453 (1936). (I P) (T) (C L)

O. Masaki and K. Kobayakawa, J. Sci. Hirosima Univ. [A] **6,** 217 (1936). (C L)

F. A. Jenkins and E. Segrè, Phys. Rev. **55,** 545 (1939). (Z E)

W. F. Meggers, J. Opt. Soc. Am. **36,** 431 (1946). (Summary hfs)

H. R. Kratz, unpublished material (Dec. 1947). (I P) (T)

Config.	Desig.	J	Level	Interval
$3p^6(^1S)4s$	$4s\ ^2S$	½	0.00	
$3p^6(^1S)4p$	$4p\ ^2P°$	½ 1½	12985.17 13042.89	57.72
$3p^6(^1S)5s$	$5s\ ^2S$	½	21026.8	
$3p^6(^1S)3d$	$3d\ ^2D$	2½ 1½	21534.42 21536.75	−2.33
$3p^6(^1S)5p$	$5p\ ^2P°$	½ 1½	24701.44 24720.20	18.76
$3p^6(^1S)4d$	$4d\ ^2D$	2½ 1½	27397.01 27398.11	−1.10
$3p^6(^1S)6s$	$6s\ ^2S$	½	27450.65	
$3p^6(^1S)4f$	$4f\ ^2F°$	{ 3½ 2½ }	28127.7	
$3p^6(^1S)6p$	$6p\ ^2P°$	½ 1½	28999.29 29007.70	8.41
$3p^6(^1S)5d$	$5d\ ^2D$	2½ 1½	30185.18 30185.69	−0.51
$3p^6(^1S)7s$	$7s\ ^2S$	½	30274.26	
$3p^6(^1S)5f$	$5f\ ^2F°$	{ 3½ 2½ }	30605.6	
$3p^6(^1S)5g$	$5g\ ^2G$	{ 3½ 4½ }	[30619.8]	
$3p^6(^1S)7p$	$7p\ ^2P°$	½ 1½	31069.98 31074.46	4.48
$3p^6(^1S)6d$	$6d\ ^2D$	2½ 1½	31695.51 31695.75	−0.24
$3p^6(^1S)8s$	$8s\ ^2S$	½	31764.95	
$3p^6(^1S)6f$	$6f\ ^2F°$	{ 3½ 2½ }	31953.0	
$3p^6(^1S)6h$	$6h\ ^2H°$	{ 4½ 5½ }	[31960.6]	
$3p^6(^1S)6g$	$6g\ ^2G$	{ 3½ 4½ }	[31960.8]	
$3p^6(^1S)8p$	$8p\ ^2P°$	½ 1½	32227.42 32230.12	2.70
$3p^6(^1S)7d$	$7d\ ^2D$	{ 2½ 1½ }	32598.46	
$3p^6(^1S)9s$	$9s\ ^2S$	½	32648.17	
$3p^6(^1S)7f$	$7f\ ^2F°$	{ 3½ 2½ }	32764.52	
$3p^6(^1S)9p$	$9p\ ^2P°$	½ 1½	32940.34 32942.08	1.74
$3p^1(^1S)8d$	$8d\ ^2D$	{ 2½ 1½ }	33178.36	
$3p^6(^1S)10s$	$10s\ ^2S$	½	33214.39	
$3p^6(^1S)8f$	$8f\ ^2F°$	{ 3½ 2½ }	33291.04	
$3p^6(^1S)10p$	$10p\ ^2P°$	½ 1½	33410.34 33411.54	1.20
$3p^6(^1S)9d$	$9d\ ^2D$	{ 2½ 1½ }	33572.11	

Config.	Desig.	J	Level	Interval
$3p^6(^1S)11s$	$11s\ ^2S$	½	33598.17	
$3p^6(^1S)9f$	$9f\ ^2F°$	{ 3½ 2½ }	33652.0	
$3p^6(^1S)11p$	$11p\ ^2P°$	½ 1½	33736.60 33737.44	0.84
$3p^6(^1S)10d$	$10d\ ^2D$	{ 2½ 1½ }	33851.76	
$3p^6(^1S)12s$	$12s\ ^2S$	½	33869.7	
$3p^6(^1S)12p$	$12p\ ^2P°$	½ 1½	33972.34 33972.94	0.60
$3p^6(^1S)11d$	$11d\ ^2D$	{ 2½ 1½ }	34056.9	
$3p^6(^1S)13s$	$13s\ ^2S$	½	34069.3	
$3p^6(^1S)13p$	$13p\ ^2P°$	½ 1½	34148.15 34148.63	0.48
$3p^6(^1S)14p$	$14p\ ^2P°$	½ 1½	34282.77 34283.15	0.38
$3p^6(^1S)15p$	$15p\ ^2P°$	½ 1½	34388.16 34388.46	0.30
$3p^6(^1S)16p$	$16p\ ^2P°$	½ 1½	34472.18 34472.43	0.25
$3p^6(^1S)17p$	$17p\ ^2P°$	½ 1½	34540.23 34540.44	0.21
$3p^6(^1S)18p$	$18p\ ^2P°$	{ ½ 1½ }	34596.27	
$3p^6(^1S)19p$	$19p\ ^2P°$	{ ½ 1½ }	34642.78	
$3p^6(^1S)20p$	$20p\ ^2P°$	{ ½ 1½ }	34681.84	
$3p^6(^1S)21p$	$21p\ ^2P°$	{ ½ 1½ }	34714.98	
$3p^6(^1S)22p$	$22p\ ^2P°$	{ ½ 1½ }	34743.37	
$3p^6(^1S)23p$	$23p\ ^2P°$	{ ½ 1½ }	34767.78	
$3p^6(^1S)24p$	$24p\ ^2P°$	{ ½ 1½ }	34789.03	
$3p^6(^1S)25p$	$25p\ ^2P°$	{ ½ 1½ }	34807.62	
$3p^6(^1S)26p$	$26p\ ^2P°$	{ ½ 1½ }	34823.83	
$3p^6(^1S)27p$	$27p\ ^2P°$	{ ½ 1½ }	34838.30	
$3p^6(^1S)28p$	$28p\ ^2P°$	{ ½ 1½ }	34851.11	
$3p^6(^1S)29p$	$29p\ ^2P°$	{ ½ 1½ }	34862.52	
$3p^6(^1S)30p$	$30p\ ^2P°$	{ ½ 1½ }	34872.70	
$3p^6(^1S)31p$	$31p\ ^2P°$	{ ½ 1½ }	34881.94	
$3p^6(^1S)32p$	$32p\ ^2P°$	{ ½ 1½ }	34890.20	

K I—Continued					K I—Continued				
Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3p^6(^1S)33p$	$33p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34897.75		$3p^6(^1S)58p$	$58p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34975.15	
$3p^6(^1S)34p$	$34p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34904.57		$3p^6(^1S)59p$	$59p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34976.36	
$3p^6(^1S)35p$	$35p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34910.79		$3p^6(^1S)60p$	$60p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34977.50	
$3p^6(^1S)36p$	$36p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34916.51		$3p^6(^1S)61p$	$61p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34978.62	
$3p^6(^1S)37p$	$37p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34921.69		$3p^6(^1S)62p$	$62p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34979.60	
$3p^6(^1S)38p$	$38p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34926.47		$3p^6(^1S)63p$	$63p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34980.65	
$3p^6(^1S)39p$	$39p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34930.91		$3p^6(^1S)64p$	$64p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34981.58	
$3p^6(^1S)40p$	$40p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34934.97		$3p^6(^1S)65p$	$65p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34982.47	
$3p^6(^1S)41p$	$41p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34938.72		$3p^6(^1S)66p$	$66p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34983.27	
$3p^6(^1S)42p$	$42p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34942.20		$3p^6(^1S)67p$	$67p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34984.10	
$3p^6(^1S)43p$	$43p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34945.49		$3p^6(^1S)68p$	$68p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34984.83	
$3p^6(^1S)44p$	$44p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34948.48		$3p^6(^1S)69p$	$69p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34985.57	
$3p^6(^1S)45p$	$45p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34951.26		$3p^6(^1S)70p$	$70p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34986.25	
$3p^6(^1S)46p$	$46p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34953.85		$3p^6(^1S)71p$	$71p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34986.96	
$3p^6(^1S)47p$	$47p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34956.32		$3p^6(^1S)72p$	$72p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34987.53	
$3p^6(^1S)48p$	$48p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34958.61		$3p^6(^1S)73p$	$73p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34988.19	
$3p^6(^1S)49p$	$49p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34960.73		$3p^6(^1S)74p$	$74p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34988.85	
$3p^6(^1S)50p$	$50p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34962.83		$3p^6(^1S)75p$	$75p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34989.4	
$3p^6(^1S)51p$	$51p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34964.67		$3p^6(^1S)76p$	$76p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34989.9	
$3p^6(^1S)52p$	$52p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34966.45		$3p^6(^1S)77p$	$77p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34990.5	
$3p^6(^1S)53p$	$53p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34968.09		$3p^6(^1S)78p$	$78p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34990.8	
$3p^6(^1S)54p$	$54p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34969.69		$3p^6(^1S)79p$	$79p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34991.2	
$3p^6(^1S)55p$	$55p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34971.17		--------	--------	-------	--------	
$3p^6(^1S)56p$	$56p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34972.57		K II ($^1S_0$)	Limit	-------	35009.78	
$3p^6(^1S)57p$	$57p\ ^2P^\circ$	{ $\frac{1}{2}$ $1\frac{1}{2}$ }	34973.88		$3p^5(^3P_2^\circ)4s^2$ $3p^5(^1P_1^\circ)4s^2$	$4s^2\ ^2P^\circ$	$1\frac{1}{2}$ $\frac{1}{2}$	150970 153066	-2096

May 1948.

K II

(A I sequence; 18 electrons) $Z=19$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ {}^1S_0$

$3p^6\ {}^1S_0$ **256637** cm^{-1} I. P. 31.81 volts

Most of the levels were found by de Bruin, whose analysis is repeated in the three references listed under his name. The present list is taken from the paper by Bowen, who extended the earlier work by observations in the ultraviolet near 600 A, which served to connect de Bruin's levels with the ground term. Bowen also determined the limit from the 4s- and 5s-series and extended the assignments of the Paschen notation to all but 2 of the 20 levels thus far identified in this spectrum. This notation is entered in column one of the table under the heading "A I".

As for A I, the jl-coupling notation in the general form suggested by Racah is adopted. The writer has suggested tentatively the tabular designation of the level labeled Y_{11} by de Bruin. The pairs $nd[3\tfrac{1}{2}]°$ and $nd[1\tfrac{1}{2}]°$ are partially inverted as compared with Ne I.

The LS-designations $ns\ {}^3P°_{210}$, ${}^1P°_1$ can probably be safely assigned to the levels ns_5, ns_4, ns_3, ns_2, respectively.

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K II

A I	de Bruin	Config.	Desig.	J	Level
$1p_0$		$3p^6$	$3p^6$ ^1S	0	0
$1s_5$	X_2	$3p^5(^2P^o_{1\frac{1}{2}})4s$	$4s$ $[1\frac{1}{2}]°$	2	*162507. 0*
$1s_4$	X_3			1	*163237. 0*
$1s_3$	X_7	$3p^5(^2P^o_{\frac{1}{2}})4s$	$4s'$ $[\frac{1}{2}]°$	0	*165149. 5*
$1s_2$	X_8			1	*166461. 5*
$3d_6$	X_4	$3p^5(^2P^o_{1\frac{1}{2}})3d$	$3d$ $[\frac{1}{2}]°$	0	*163436. 3*
$3d_5$	X_5			1	*164496. 1*
		"	$3d$ $[3\frac{1}{2}]°$	4	
$3d_4$	X_9			3	*170835. 4*
$3d_3$	X_6	"	$3d$ $[1\frac{1}{2}]°$	2	*164932. 3*
				1	
$3d''_1$	X_{10}	"	$3d$ $[2\frac{1}{2}]°$	2	*171526. 8*
				3	
$2p_{10}$	P_1	$3p^5(^2P^o_{1\frac{1}{2}})4p$	$4p$ $[\frac{1}{2}]$	1	183208. 4
$2p_9$	P_2	"	$4p$ $[2\frac{1}{2}]$	3	186388. 5
$2p_8$	P_3			2	186685. 6
$2p_7$	P_4	"	$4p$ $[1\frac{1}{2}]$	1	187531. 1
$2p_6$	P_5			2	188154. 4
$2p_5$	P_8	"	$4p$ $[\frac{1}{2}]$	0	189772. 0
$2p_4$	P_6	$3p^5(^2P^o_{\frac{1}{2}})4p$	$4p'$ $[1\frac{1}{2}]$	1	189243. 7
$2p_3$	P_7			2	189661. 7

A I	de Bruin	Config.	Desig.	J	Level
$2p_2$	P_9	$3p^5(^2P^o_{\frac{1}{2}})4p$	$4p'$ $[\frac{1}{2}]$	1	190134. 8
$2p_1$	P_{10}			0	194776. 1
$2s_5$	Y_2	$3p^5(^2P^o_{1\frac{1}{2}})5s$	$5s$ $[1\frac{1}{2}]°$	2	*212575. 5*
$2s_4$	Y_3			1	*212992. 9*
$2s_3$	Y_4	$3p^5(^2P^o_{\frac{1}{2}})5s$	$5s'$ $[\frac{1}{2}]°$	0	*214727. 0*
$2s_2$	Y_5			1	*215018. 8*
$4d_5$	Y_6	$3p^5(^2P^o_{1\frac{1}{2}})4d$	$4d$ $[\frac{1}{2}]°$	0	*215404. 9*
				1	
$4d_4$	Y_9	"	$4d$ $[3\frac{1}{2}]°$	4	*217726. 4*
				3	
$4d_3$	Y_7	"	$4d$ $[1\frac{1}{2}]°$	2	*215855. 8*
				1	
$4d''_1$	Y_{10}	"	$4d$ $[2\frac{1}{2}]°$	2	*219196. 2*
				3	
	Y_8	$3p^5(^2P^o_{\frac{1}{2}})4d$	$4d'$ $[\ ?\ ]°$	2	*217066. 3*
	Y_{11}	"	$4d'$ $[1\frac{1}{2}]°$	2	*223124. 1*
K III ($^2P^o_{1\frac{1}{2}}$)			*Limit*		**256637**
K III ($^2P^o_{\frac{1}{2}}$)			*Limit*		258803

Config. $1s^2\,2s^2\,2p^6\,3s^2+$	Observed Terms	
$3p^6$	$3p^6\ {}^1\mathrm{S}$	
	$ns\ (n\geq 4)$	
$3p^5({}^2\mathrm{P}^\circ)nx$	$\Big\{$ $\begin{array}{l}4,\,5s\ \ {}^3\mathrm{P}^\circ\\ 4,\,5s\ \ {}^1\mathrm{P}^\circ\end{array}$	

	jl-Coupling Notation		
	Observed Levels		
	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 3)$
$3p^5({}^2\mathrm{P}^\circ_{1\frac12})nx$	$4,\,5s\,[1\frac12]^\circ$	$4p\,[\ \frac12]$ $4p\,[2\frac12]$ $4p\,[1\frac12]$	$3,\,4d\,[\ \frac12]^\circ$ $3,\,4d\,[3\frac12]^\circ$ $3,\,4d\,[1\frac12]^\circ$ $3,\,4d\,[2\frac12]^\circ$
$3p^5({}^2\mathrm{P}^\circ_{\frac12})nx'$	$4,\,5s'[\ \frac12]^\circ$	$4p'[1\frac12]$ $4p'[\ \frac12]$	$4d'[1\frac12]^\circ$

*For predicted levels in the spectra of the A I isoelectronic sequence, see Introduction.

K III

(Cl I sequence; 17 electrons)   Z=19

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^5\ {}^2\mathrm{P}^\circ_{1\frac12}$

$3p^5\ {}^2\mathrm{P}^\circ_{1\frac12}$ *369000* cm^{-1} I. P. 46 volts

The analyses by various investigators are discordant, but nearly 80 lines have been classified in the range between 325 A and 3885 A.

From observed intersystem combinations Edlén has derived a correction of $+667.7$ cm^{-1} to the absolute values of the doublet terms given by de Bruin, to connect them with the quartet terms. Edlén also states that the limit derived by extrapolation along the isoelectronic sequence is 369000 cm^{-1}. This limit (entered in brackets in the table), indicates a correction of about -8000 cm^{-1} to the limit listed by de Bruin, 377000 cm^{-1}.

The doublet terms as given by Edlén and the quartet terms from de Bruin have been used in compiling the present list. The additional terms are from Tsien.

Kruger and Phillips designate as $4s''\ {}^2\mathrm{S}_{\frac12}$ the level at 246012 cm^{-1}, given by Tsien as $3d'\ {}^2\mathrm{D}_{1\frac12}$. Further study is needed to confirm the terms from the higher limits.

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W.-Z. Tsien, Chinese J. Phys. **3**, No. 2, 118 (1939).   (T) (C L)

K III

Config.	Desig.	J	Level	Interval
3s² 3p⁵	3p⁵ ²P°	1½ ½	0 *2162*	−2162
3p⁶	3p⁶ ²S	½	130609	
3s² 3p⁴(³P)3d	3d ²D	1½ 2½	190916 192082	1166
3s² 3p⁴(³P)3d	3d ²F	{ 3½ 2½ }	201165	
3s² 3p⁴(³P)4s	4s ⁴P	2½ 1½ ½	207421.9 208687.8 209461.3	−1265.9 −773.5
3s² 3p⁴(³P)4s	4s ²P	1½ ½	212725.4 214232.3	−1506.9
3s² 3p⁴(¹D)4s	4s' ²D	2½ 1½	225051 225082	−31
3s² 3p⁴(³P)4p	4p ⁴P°	2½ 1½ ½	*237512.0 237912.2 238455.1*	−400.2 −542.9
3s² 3p⁴(³P)4p	4p ⁴D°	3½ 2½ 1½ ½	*240829.9 241443.5 242165.3 242526.7*	−613.6 −721.8 −361.4
3s² 3p⁴(¹D)3d	3d' ²P	1½ ½	241039 242548	−1509

K III

Config.	Desig.	J	Level	Interval
3s² 3p⁴(¹S)4s	4s'' ²S	½	241667	
3s² 3p⁴(³P)4p	4p ²D°	2½ 1½	*243120.6 243448.2*	−327.6
3s² 3p⁴(³P)4p	4p ²P°	1½ ½	*243947.4 245382.3*	−1434.9
3s² 3p⁴(¹D)3d	3d' ²D	2½ 1½	244523 246012	−1489
3s² 3p⁴(³P)4p	4p ⁴S°	1½	*246625.6*	
3s² 3p⁴(¹D)3d	3d' ²S	½	250857	
		1	252040	
3s² 3p⁴(³P)5s	5s ²P	1½ ½	262828 263770	−942
3s² 3p⁴(¹D)5s	5s' ²D	2½ 1½	289400 289515	−115
3s² 3p⁴(¹S)3d	3d'' ²D	2½ 1½	302404 303902	−1498
		2	307429	
K IV (³P₂)	Limit	-------	[369000]	

January 1948.

K III Observed Terms*

Config. 1s² 2s² 2p⁶	Observed Terms		
3s² 3p⁵	3p⁵ ²P°		
3s 3p⁶	3p⁶ ²S		
	ns (n ≥ 4)	np (n ≥ 4)	nd (n ≥ 3)
3s² 3p⁴(³P)nx	4s ⁴P 4, 5s ²P 4p ⁴S°	4p ⁴P° 4p ⁴D° 4p ²P° 4p ²D°	3d ²D 3d ²F
3s² 3p⁴(¹D)nx'	4, 5s' ²D		3d' ²S 3d' ²P 3d' ²D
3s² 3p⁴(¹S)nx''	4s'' ²S		3d'' ²D

*For predicted terms in the spectra of the Cl I isoelectronic sequence, see Introduction.

K IV

(S I sequence; 16 electrons) $Z=19$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^4\,{}^3P_2$

$3p^4\,{}^3P_2$ **491300 cm^{-1}**   I. P. 60.90 volts

The terms are from the papers by Bowen and by Tsien, with the revised values of $3p^4\,{}^1S$ and $3p^5\,{}^3P°$ suggested by Edlén, and of $4s\,{}^3S°$ by Mrs. Beckman. Colons have been added by the writer to some levels that appear to need further confirmation.

Nearly 60 lines have been classified in the region between 271 A and 754 A. Intersystem combinations connecting the singlet and triplet terms have been observed.

The limit is from Edlén's 1937 paper. He has derived it by extrapolation of isoelectronic sequence data.

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K IV

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^4$	$3p^4\,{}^3P$	2	0	1673	$3s^2\,3p^3(^4S°)4s$	$4s\,{}^3S°$	1	260352	
		1	1673	651	$3s^2\,3p^3(^2P°)3d$	$3d''\,{}^1P°$	1	261445	
		0	2324						
$3s^2\,3p^4$	$3p^4\,{}^1D$	2	16386		$3s^2\,3p^3(^2P°)3d$	$3d''\,{}^3D°$	3		
							2	262831	−828
$3s^2\,3p^4$	$3p^4\,{}^1S$	0	38548				1	263659	
$3s\,3p^5$	$3p^5\,{}^3P°$	2	134181	−1478	$3s^2\,3p^3(^2P°)3d$	$3d''\,{}^1D°$	2	273409	
		1	135659	−794	$3s^2\,3p^3(^2D°)4s$	$4s'\,{}^3D°$	1	277795	56
		0	136453				2	277851	135
$3s\,3p^5$	$3p^5\,{}^1P°$	1	171140				3	277986	
$3s^2\,3p^3(^4S°)3d$	$3d\,{}^3D°$	3	189952	−252	$3s^2\,3p^3(^2D°)4s$	$4s'\,{}^1D°$	2	282373	
		2	191204	−199	$3s^2\,3p^3(^2P°)4s$	$4s''\,{}^3P°$	0	293384	89
		1	191403				1	293473	247
$3s^2\,3p^3(^2D°)3d$	$3d'\,{}^1F°$	3	222420				2	293720	
$3s^2\,3p^3(^2D°)3d$	$3d'\,{}^3P°$	2	225445	−645	$3s^2\,3p^3(^2P°)4s$	$4s''\,{}^1P°$	1	298134	
		1	226090	−1562	$3s^2\,3p^3(^4S°)5s$	$5s\,{}^3S°$	1	367890	
		0	227652						
$3s^2\,3p^3(^2D°)3d$	$3d'\,{}^1P°$	1	235527:		K v ($^4S_{1½}$)	*Limit*		491300	
$3s^2\,3p^3(^3P°)3d$	$3d''\,{}^3P°$	2	256084	−1090					
		1	257124	−687					
		0	257811:						

December 1947.

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms				
$3s^2\,3p^4$	$\Big\{$ $3p^4\ {}^1\mathrm{S}$	$3p^4\ {}^3\mathrm{P}$ $3p^4\ {}^1\mathrm{D}$			
$3s\,3p^5$	$\Big\{$	$3p^5\ {}^3\mathrm{P}^\circ$ $3p^5\ {}^1\mathrm{P}^\circ$			
	$ns\ (n\geq 4)$		$nd\ (n\geq 3)$		
$3s^2\,3p^3({}^4\mathrm{S}^\circ)nx$	$4,5s\ \ {}^3\mathrm{S}^\circ$		$3d\ \ {}^3\mathrm{D}^\circ$		
$3s^2\,3p^3({}^2\mathrm{D}^\circ)nx'$	$\Big\{$	$4s'\ {}^3\mathrm{D}^\circ$ $4s'\ {}^1\mathrm{D}^\circ$	$3d'\ {}^3\mathrm{P}^\circ$ $3d'\ {}^1\mathrm{P}^\circ$		$3d'\ {}^1\mathrm{F}^\circ$
$3s^2\,3p^3({}^2\mathrm{P}^\circ)nx''$	$\Big\{$	$4s''\ {}^3\mathrm{P}^\circ$ $4s''\ {}^1\mathrm{P}^\circ$	$3d''\ {}^3\mathrm{P}^\circ$ $3d''\ {}^1\mathrm{P}^\circ$	$3d''\ {}^3\mathrm{D}^\circ$ $3d''\ {}^1\mathrm{D}^\circ$	

*For predicted terms in the spectra of the S I isoelectronic sequence, see Introduction.

K V

(P I sequence; 15 electrons) $Z=19$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^3\ {}^4\mathrm{S}^\circ_{1\frac{1}{2}}$

$3p^3\ {}^4\mathrm{S}^\circ_{1\frac{1}{2}}$ cm^{-1} I. P.   volts

     The analysis is incomplete. The terms are from the paper by Tsien, who includes those given earlier by Bowen. Seventy-two lines have been classified in the interval between 294 A and 825 A.

     The relative position of the doublet terms with respect to the quartet terms was estimated from the irregular doublet law. Tsien lists combinations of $3p^3\ {}^4\mathrm{S}^\circ$ and $3p^3\ {}^2\mathrm{P}^\circ$ with the level labeled "3", which are not in disagreement with this estimate.

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W.—Z. Tsien, Chinese J. Phys. **3,** No. 2, 136 (1939). (T) (C L)

K v

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^3$	$3p^3$ $^4S°$	1½	0		$3s^2\,3p^2(^3P)3d$	$3d$ ^2F	2½ 3½	262487 262874	387
$3s^2\,3p^3$	$3p^3$ $^2D°$	1½ 2½	24000 24237	237	$3s^2\,3p^2(^3P)3d$	$3d$ ^2D	2½ 1½	264741 264932	−191
$3s^2\,3p^3$	$3p^3$ $^2P°$	½ 1½	39745 40064	319			3	268043	
$3s\,3p^4$	$3p^4$ ^4P	2½ 1½ ½	136639 138042 138806	−1403 −764			4	274375	
$3s\,3p^4$	$3p^4$ ^2D	1½ 2½	161199 161564	365	$3s^2\,3p^2(^1D)3d$	$3d'$ ^2D	1½ 2½	281024	
		1	169703		$3s^2\,3p^2(^1D)3d$	$3d'$ ^2P	½ 1½	 290772	
		2	169886		$3s^2\,3p^2(^1D)3d$	$3d'$ ^2F	2½ 3½	292710	
$3s\,3p^4$	$3p^4$ ^2P	1½ ½	194792 196319	−1527	$3s^2\,3p^2(^1D)3d$	$3d'$ ^2S	1½	292968	
$3s\,3p^4$	$3p^4$ ^2S	½	205784		$3s^2\,3p^2(^1S)3d$	$3d''$ ^2D	1½ 2½	304461 305978	1517
$3s^2\,3p^2(^3P)3d$	$3d$ ^4F	1½ 2½ 3½ 4½	206720 207165	445			5	307717	
$3s^2\,3p^2(^3P)3d$	$3d$ ^4D	3½ 2½ 1½ ½	222367 222711	−344			6	310120	
					$3s^2\,3p^2(^3P)4s$	$4s$ ^4P	½ 1½ 2½	336628 337645 339172	1017 1527
$3s^2\,3p^2(^3P)3d$	$3d$ ^4P	2½ 1½ ½	257865 259276 259726	−1411 −450	$3s^2\,3p^2(^3P)4s$	$4s$ ^2P	½ 1½	343726 345526	1800
$3s^2\,3p^2(^3P)3d$	$3d$ ^2P	1½ ½	259205 260868	−1663	$3s^2\,3p^2(^1D)4s$	$4s'$ ^2D	2½ 1½	356993 357033	−40

November 1947.

K v Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms					
$3s^2\,3p^3$	$\{$ $3p^3$ $^4S°$	$3p^3$ $^2P°$	$3p^3$ $^2D°$			
$3s\,3p^4$	$\{$ $3p^4$ ^2S	$3p^4$ ^4P $3p^4$ ^2P	$3p^4$ ^2D			

	ns $(n\geq 4)$		nd $(n\geq 3)$			
$3d^2\,3p^2(^3P)nx$	$\{$ $4s$ ^4P $4s$ ^2P			$3d$ ^4P $3d$ ^2P	$3d$ ^4D $3d$ ^2D	$3d$ ^4F $3d$ ^2F
$3s^2\,3p^2(^1D)nx'$		$4s'$ ^2D	$3d'$ ^2S	$3d'$ ^2P	$3d'$ ^2D	$3d'$ ^2F
$3s^2\,3p^2(^1S)nx''$					$3d''$ ^2D	

*For predicted terms in the P I isoelectronic sequence, see Introduction.

K VI

(Si I sequence; 14 electrons) $Z=19$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2\ {}^3P_0$

$3p^2\ {}^3P_0$ 804513 cm^{-1} I. P. 99.7 volts

The analysis is chiefly by Whitford, with singlet terms added from Robinson's paper. Twenty-seven lines have been classified in the interval between 256 A and 725 A. Intersystem combinations connecting the singlet and triplet terms have been observed.

Using the method suggested by Edlén for extrapolation along the isoelectronic sequence, the writer has estimated the value of the limit quoted above and entered in brackets in the table.

REFERENCES

A. E. Whitford, Phys. Rev. **46**, 793 (1934).   (T) (C L)
H. A. Robinson, Phys. Rev. **52**, 725 (1937).   (T) (C L)

K VI   **K VI**

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\ 3p^2$	$3p^2\ {}^3P$	0	0	1131	$3s\ 3p^3$	$3p^3\ {}^1P^\circ$	1	223840	
		1	1131	1793	$3s^2\ 3p(^2P^\circ)3d$	$3d\ {}^3P^\circ$	2	252332	
		2	2924				1	253504	-1172
$3s^2\ 3p^2$	$3p^2\ {}^1D$	2	18973				0	254043	-539
$3s\ 3p^3$	$3p^3\ {}^3D^\circ$	1	140743		$3s^2\ 3p(^2P^\circ)4s$	$4s\ {}^3P^\circ$	0	387421	
		2	140796	53			1	388114	693
		3	140966	170			2	390493	2379
$3s\ 3p^3$	$3p^3\ {}^3P^\circ$	2, 1, 0	163434						
$3s\ 3p^3$	$3p^3\ {}^3S^\circ$	1	218316		K VII ($^2P^\circ_{1/2}$)	*Limit*		[804513]	

October 1947.

K VII

(Al I sequence; 13 electrons) $\qquad$ $Z=19$

Ground state $1s^2\, 2s^2\, 2p^6\, 3s^2\, 3p\; {}^2P^\circ_{1/2}$

$3p\; {}^2P^\circ_{1/2}\; \boldsymbol{950200}$ cm^{-1} $\qquad$ I. P. 118 volts

Both Whitford and Phillips have worked on the analysis of this spectrum. Thirty lines have been classified in the interval between 175 A and 671 A. No intersystem combinations have been observed, but Phillips estimates that $3p^2\; {}^4P_{1/2}$ is approximately 114000cm^{-1} above the ground state. This value is entered in brackets in the table. The uncertainty x may exceed ±1000 cm^{-1}.

Using the method suggested by Edlén, the writer has extrapolated the value of the limit quoted above and entered in brackets in the table. The uncertainty in this estimate is large owing to the incompleteness of the isoelectronic sequence data.

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L. W. Phillips, Phys. Rev. **55, 708** (1939). (T) (C L)

K VII

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$3p\; {}^2P^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$	*0* *3129*	3129	$3s\, 3p(^3P^\circ)3d$	$3d\; {}^4D^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$ $3\frac{1}{2}$	*365092*$+x$ *365463*$+x$ *365778*$+x$ *365916*$+x$	371 315 138
$3s\, 3p^2$	$3p^2\; {}^4P$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	$[114000]+x$ $115145+x$ $116871+x$	1145 1726	$3s^2(^1S)4s$	$4s\; {}^2S$	$\frac{1}{2}$	439297	
$3s\, 3p^2$	$3p^2\; {}^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	151882 152049	167	$3s\, 3p(^3P^\circ)4s$	$4s\; {}^4P^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	*565314*$+x$ *566443*$+x$ *568375*$+x$	1129 1932
$3s\, 3p^2$	$3p^2\; {}^2S$	$\frac{1}{2}$	193079						
$3s\, 3p^2$	$3p^2\; {}^2P$	$\frac{1}{2}$ $1\frac{1}{2}$	206507 208434	1927	$3s^2(^1S)4d$	$4d\; {}^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	570812 570969	157
$3s^2(^1S)3d$	$3d\; {}^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	250668 250787	119	K VIII $(^1S_0)$	*Limit*	------	$[\boldsymbol{950200}]$	
$3p^3$	$3p^3\; {}^4S^\circ$	$1\frac{1}{2}$	*307479* $+x$						

September 1947.

K VII Observed Terms*

Config. $1s^2\, 2s^2\, 2p^6+$	Observed Terms	
$3s^2(^1S)3p$	$3p\; {}^2P^\circ$	
$3s\, 3p^2$	$\left\{\begin{array}{l}\\ 3p^2\; {}^2S \end{array}\right.$ $\begin{array}{l} 3p^2\; {}^4P \\ 3p^2\; {}^2P \quad 3p^2\; {}^2D \end{array}$	
$3p^3$	$3p^3\; {}^4S^\circ$	
	$ns\; (n\geq 4)$	$nd\; (n\geq 3)$
$3s^2(^1S)nx$	$4s\; {}^2S$	$3,\, 4d\; {}^2D$
$3s\, 3p(^3P^\circ)nx$	$4s\; {}^4P^\circ$	$3d\; {}^4D^\circ$

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

K VIII

(Mg I sequence; 12 electrons) $Z=19$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,{}^1S_0$

$3s^2\,{}^1S_0\ 1247000\pm\ \ cm^{-1}$ I. P. $155\pm$ volts

Twenty-six lines have been classified in the range between 155 A and 938 A.   The triplet terms are from Parker and Phillips; the singlets from Tsien.   By extrapolation along the sequence Mrs. Beckman has classified a line at 774.738 A as the intersystem combination $3s^2\,{}^1S_0-3p\,{}^3P_1^\circ$.   The listed values of the triplet terms have been adjusted to fit this assignment.

From isoelectronic sequence data the writer has extrapolated the value of the limit, using the method suggested by Edlén.   This value is entered in brackets in the table.   Although this estimate may be in error by more than ±1000 cm^{-1}, it gives an approximate value of the ionization potential.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 55 (Almqvist and Wiksells Boktryckeri-A.-B., Uppsala, 1937).   (C L)
W.-Z. Tsien, Chinese J. Phys. **3,** No. 2, 142 (1939).   (T) (C L)
W. L. Parker and L. W. Phillips, Phys. Rev. **57,** 140 (1940).   (T) (C L)

K VIII

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ {}^1S$	0	0		$3s({}^2S)3d$	$3d\ {}^3D$	1	368004	56
$3s({}^2S)3p$	$3p\ {}^3P^\circ$	0	*127968*				2	368060	72
		1	*129080*	1112			3	368132	
		2	*131452*	2372	$3s({}^2S)4s$	$4s\ {}^3S$	1	631654	
$3s({}^2S)3p$	$3p\ {}^1P^\circ$	1	*192540. 2*		$3s({}^2S)4d$	$4d\ {}^3D$	1	770165	95
$3s({}^2S)3d$	$3d\ {}^1D$	2	*299117. 4*				2	770260	141
$3p^2$	$3p^2\ {}^3P$	0	304669				3	770401	
		1	306035	1366	$3s({}^2S)4f$	$4f\ {}^3F^\circ$	2, 3, 4	*801511*	
		2	308608	2573					
					K IX $({}^2S_{1/2})$	*Limit*	--------	[1247000±]	

March 1948.

K IX

(Na I sequence; 11 electrons) $Z=19$

Ground state $1s^2\, 2s^2\, 2p^6\, 3s\ {}^2S_{1/2}$

$3s\ {}^2S_{1/2}$ **1419425** cm^{-1} I. P. 175.94 volts

All but two of the terms are from the paper by Kruger and Phillips, who extended the earlier work by Edlén and Whitford. Absolute term values are based on three members of the ^{2}D-series.

The two terms $5s$ ^{2}S and $5g$ ^{2}G have been added from the paper by Tsien, but adjusted to agree with the term array by Kruger and Phillips.

Twenty-five lines have been classified, in the range from 112 A to 636 A.

REFERENCES

W.–Z. Tsien, Chinese J. Phys. **3**, No. 2, 145 (1939). (T) (C L)
P. G. Kruger and L. W. Phillips, Phys. Rev. **55**, 352 (1939). (I P) (T) (C L)

K IX   K IX

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
3s	3s ²S	½	0		5s	5s ²S	½	979901	
3p	3p ²P°	½	*157159*	3766	5g	5g ²G	4½	1044250	−48
		1½	*160925*				3½	1044298	
3d	3d ²D	1½	374788	292	5d	5d ²D	1½	1049114	60
		2½	375080				2½	1049174	
4s	4s ²S	½	698902		5f	5f ²F°	2½	*1061120*	52
4p	4p ²P°	½	*758174*	1441			3½	*1061172*	
		1½	*759615*						
4d	4d ²D	1½	836703	158	K x (¹S₀)	*Limit*		1419425	
		2½	836861						
4f	4f ²F°	2½	*860763*	79					
		3½	*860842*						

June 1947.

K x

(Ne I sequence; 10 electrons) $Z=19$

Ground state $1s^2\, 2s^2\, 2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ **4064300** cm^{-1} I. P. 503.8 volts

Eleven lines between 29 A and 41 A have been classified by Edlén and Tyrén as combinations with the ground term. Their absolute term values have been extrapolated along the Ne I isoelectronic sequence.

By analogy with Ne I, jl-coupling notation in the general form suggested by Racah is introduced.

The unit adopted by Edlén and Tyrén, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

B. Edlén and F. Tyrén, Zeit. Phys. **101**, 206 (1936). (I P) (T) (C L)
G. Racah, Phys. Rev. **61**, 537 (L) (1942).

K x   K x

Authors	Config.	Desig.	J	Level	Authors	Config.	Desig.	J	Level
2p ¹S₀	2s² 2p⁶	2p⁶ ¹S	0	0		2s 2p⁶(²S)3p	3p ³P°	2 1 0	3219400
					3p' ³P₁				
3s ³P₁	2s² 2p⁵(²P°₁½)3s	3s [1½]°	2 1	2407300	3p' ¹P₁	2s 2p⁶(²S)3p	3p ¹P°	1	3237600
3s ¹P₁	2s² 2p⁵(²P°½)3s	3s' [½]°	0 1	2430300	4d ¹P₁	2s² 2p⁵(²P°₁½)4d	4d [1½]°	1	3356400
					4d ³D₁	2s² 2p⁵(²P°½)4d	4d' [1½]°	1	3379700
3d ³P₁	2s² 2p⁵(²P°₁½)3d	3d [½]°	0 1	2760200					
3d ¹P₁	"	3d [1½]°	1	2794900	K xi (²P°₁½)		Limit	-------	4064300
3d ³D₁	2s² 2p⁵(²P°½)3d	3d' [1½]°	1	2832300	K xi (²P°½)		Limit	-------	4087775
4s ³P₁	2s² 2p⁵(²P°₁½)4s	4s [1½]°	2 1	3205100					
4s ¹P₁	2s² 2p⁵(²P°½)4s	4s' [½]°	0 1	3232400					

April 1947.

K x Observed Levels*

Config. 1s²+	Observed Terms		
2s² 2p⁶	2p⁶ ¹S		
	ns (n≥3)	np(n≥3)	nd (n≥3)
2s² 2p⁵(²P°)nx	{ 3, 4s ³P° 3, 4s ¹P°		3d ³P° 3, 4d ³D° 3, 4d ¹P°
2s 2p⁶(²S)nx	{	3p ³P° 3p ¹P°	

jl-Coupling Notation

	Observed Pairs		
	ns (n≥3)		nd (n≥3)
2s² 2p⁵(²P°₁½)nx	3, 4s [1½]°		3d [½]° 3, 4d [1½]°
2s² 2p⁵(²P°½)nx'	3, 4s'[½]°		3, 4d'[1½]°

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

K XI

(F I sequence; 9 electrons) $Z=19$

Ground state $1s^2\,2s^2\,2p^5\,{}^2\mathrm{P}^{\circ}_{1\frac{1}{2}}$

$2p^5\,{}^2\mathrm{P}^{\circ}_{1\frac{1}{2}}$ cm^{-1} I. P.   volts

Edlén and Tyrén have classified 8 lines, which lie between 32 A and 37 A.   They give no term array because the analysis is so incomplete.   In the 1942 reference Edlén states that the interval of the ground term is known from his unpublished material to be 23475 cm^{-1}. From these data, preliminary term values have been calculated and listed below.

REFERENCES

B. Edlén and F. Tyrén, Zeit. Phys. **101**, 206 (1936).   (C L)
B. Edlén, Zeit. Astroph. **22**, 59 (1942).   (T)

K XI

Edlén	Config.	Desig.	J	Level	Interval
$2p\ {}^2\mathrm{P}_2$ ${}^2\mathrm{P}_1$	$2s^2\,2p^5$	$2p^5\ {}^2\mathrm{P}^{\circ}$	$1\frac{1}{2}$ $\frac{1}{2}$	*0* *23475*	-23475
$3s\ {}^4\mathrm{P}_3$ ${}^4\mathrm{P}_2$	$2s^2\,2p^4({}^3\mathrm{P})3s$	$3s\ {}^4\mathrm{P}$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	2640600? 2652800?	-12200
$3s\ {}^2\mathrm{P}_2$	$2s^2\,2p^4({}^3\mathrm{P})3s$	$3s\ {}^2\mathrm{P}$	$1\frac{1}{2}$ $\frac{1}{2}$	2671300?	
$3s'\ {}^2\mathrm{D}_3$ ${}^2\mathrm{D}_2$	$2s^2\,2p^4({}^1\mathrm{D})3s$	$3s'\ {}^2\mathrm{D}$	$2\frac{1}{2}$ $1\frac{1}{2}$	2727600? 2728300?	-700
$3d$	$2s^2\,2p^4({}^3\mathrm{P})3d$	$3d\ \ \mathrm{X}$		3047900?	
$\overline{3d}$	$2s^2\,2p^4({}^1\mathrm{D})3d$	$3d'\ \mathrm{X}$		3107500?	

March 1947.

CALCIUM

Ca I

20 electrons $\qquad$ $Z=20$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,4s^2\ {}^1S_0$

$4s^2\ {}^1S_0$ **49304.80 cm^{-1}** $\qquad$ I. P. 6.111 volts

The arc spectrum of calcium occupies an important place in the development of spectro-scopic theory. In addition to the "regular" series, the terms involving two excited electrons were first discussed in the classical paper by Russell and Saunders in 1925.

Although the spectrum is well known, further observations in the infrared are urgently needed; and a monograph containing a homogeneous list of lines and term values should be prepared as soon as the analysis can be extended with the aid of these data.

The regular series terms, i. e., those from the ^2S limit in Ca II, are from Fowler and Paschen-Götze. The rest are from Russell and Saunders and from unpublished analysis by Russell, who has generously furnished all of his data on this spectrum. The $6f\ {}^3F°$ term has been resolved by Grafenberger. Three-place entries in the table are quoted from Wagman, who derived them from observations made with the interferometer. The writer has prepared a complete multiplet array and calculated all other values from the best available wavelength material. Colons indicate that the term values should be confirmed by further observations.

The singlet and triplet terms are connected by observed intersystem combinations.

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F. Paschen und R. Götze, *Seriengesetze der Linienspektren*, p. 72 (Julius Springer, Berlin, 1922). (I P) **(T)** (C L)

A. Fowler, *Report on Series in Line Spectra*, p. 121 (Fleetway Press, London, 1922). (I P) (T) (C L)

H. N. Russell and F. A. Saunders, Astroph. J. **61,** 38 (1925). (I P) (T) (C L)

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N. E. Wagman, Univ. Pittsburgh Bul. **34,** 1 (1937). (T) (C L)

H. Grafenberger, Ann. der Phys. [5] **30,** 267 (1937). (C L)

Ca I

Config.	Desig.	J	Level	Interval	Obs. g
$4s^2$	$4s^2\ ^1S$	0	0.000		
$4s(^2S)4p$	$4p\ ^3P^\circ$	0	15157.910		
		1	15210.067	52.157	
		2	15315.948	105.881	
$4s(^2S)3d$	$3d\ ^3D$	1	20335.344		0.501
		2	20349.247	13.903	1.162
		3	20370.987	21.740	1.329
$4s(^2S)3d$	$3d\ ^1D$	2	21849.610		1.007
$4s(^2S)4p$	$4p\ ^1P^\circ$	1	23652.324		
$4s(^2S)5s$	$5s\ ^3S$	1	31539.510		
$4s(^2S)5s$	$5s\ ^1S$	0	33317.25		
$3d(^2D)4p$	$4p'\ ^3F^\circ$	2	35730.450		0.754
		3	35818.712	88.262	1.076
		4	35896.890	78.178	1.245
$3d(^2D)4p$	$4p'\ ^1D^\circ$	2	35835.400		0.893
$4s(^2S)5p$	$5p\ ^3P^\circ$	0	36547.671		
		1	36554.722	7.051	
		2	36575.132	20.410	
$3d(^2D)4p$	$4p'\ ^1P^\circ$	1	36731.622		
$4s(^2S)4d$	$4d\ ^1D$	2	37298.312		
$4s(^2S)4d$	$4d\ ^3D$	1	37748.192		
		2	37751.884	3.682	
		3	37757.462	5.578	
$3d(^2D)4p$	$4p'\ ^3D^\circ$	1	38192.373		
		2	38219.094	26.721	
		3	38259.102	40.008	
$4p^2$	$4p^2\ ^3P$	0	38417.585		
		1	38464.844	47.259	
		2	38551.588	86.744	
$3d(^2D)4p$	$4p'\ ^3P^\circ$	0	39333.371		
		1	39335.316	1.945	
		2	39340.078	4.762	
$4s(^2S)6s$	$6s\ ^3S$	1	40474.275		
$3d(^2D)4p$	$4p'\ ^1F^\circ$	3	40537.860		
$4p^2$	$4p^2\ ^1S$	0	40690.436		
$4p^2$	$4p^2\ ^1D$	2	40719.867		
$4s(^2S)5p$	$5p\ ^1P^\circ$	1	41678.997		
$4s(^2S)6s$	$6s\ ^1S$	0	41786.312		
$4s(^2S)4f$	$4f\ ^3F^\circ$	2	42170.183		
		3	42170.531	0.348	
		4	42171.006	0.475	

Ca I

Config.	Desig.	J	Level	Interval	Obs. g
$4s(^2S)4f$	$4f\ ^1F^\circ$	3	42343.554		
$4s(^2S)6p$	$6p\ ^3P^\circ$	0	42514.79:		
		1	42518.72	3.93	
		2	42526.528	7.81	
$4s(^2S)5d$	$5d\ ^3D$	1	42743.058		
		2	42744.776	1.718	
		3	42747.443	2.667	
$4s(^2S)5d$	$5d\ ^1D$	2	42919.074		
$4s(^2S)6p$	$6p\ ^1P^\circ$	1	43933.341		
$4s(^2S)7s$	$7s\ ^3S$	1	43980.798		
$4s(^2S)7s$	$7s\ ^1S$	0	44276.638		
$4s(^2S)5f$	$5f\ ^3F^\circ$	2	44762.620		
		3	44762.822	0.202	
		4	44763.101	0.279	
$4s(^2S)5f$	$5f\ ^1F^\circ$	3	44804.786		
$4s(^2S)7p$	$7p\ ^3P^\circ$	0			
		1	44957.8		
		2	44961.6	3.8	
$4s(^2S)6d$	$6d\ ^1D$	2	44989.882		
$4s(^2S)6d$	$6d\ ^3D$	1	45049.066		
		2	45050.406	1.340	
		3	45052.359	1.953	
$4s(^2S)7p$	$7p\ ^1P^\circ$	1	45425.283		
$4s(^2S)8s$	$8s\ ^3S$	1	45738.732		
$4s(^2S)8s$	$8s\ ^1S$	0	45887.31		
$4s(^2S)6f$	$6f\ ^3F^\circ$	2	46164.66		
		3	46164.80	0.14	
		4	46164.99	0.19	
$4s(^2S)6f$	$6f\ ^1F^\circ$	3	46182.23		
$4s(^2S)7d$	$7d\ ^3D$	1	46302.18		
		2	46303.92	1.74	
		3	46306.170	2.25	
$4s(^2S)7d$	$7d\ ^1D$	2	46309.9		
$4s(^2S)8p$	$8p\ ^1P^\circ$	1	46479.95		
$4s(^2S)9s$	$9s\ ^3S$	1	46748.21		
$4s(^2S)9s$	$9s\ ^1S$	0	46835.2		
$4s(^2S)7f$	$7f\ ^3F^\circ$	2, 3, 4	47006.11		
$4s(^2S)7f$	$7f\ ^1F^\circ$	3	47015.137		

Config.	Desig.	J	Level	Interval	Obs. g	Config.	Desig.	J	Level	Interval	Obs. g
$4s(^2S)8d$	$8d\ ^3D$	1	47036. 32	3. 68		$4s(^2S)12f$	$12f\ ^3F°$	2, 3, 4	48531. 4		
		2	47040. 00								
		3	47045. 384	5. 38		$4s(^2S)13d$	$13d\ ^3D$	1, 2, 3	48570. 7		
$4s(^2S)9p$	$9p\ ^1P°$	1	47184. 26			$4s(^2S)13f$	$13f\ ^3F°$	2, 3, 4	48647. 1		
$4s(^2S)10s$	$10s\ ^3S$	1	47382. 10			$4s(^2S)14d$	$14d\ ^3D$	1, 2, 3	48676. 6		
$4s(^2S)10s$	$10s\ ^1S$	0	47436. 9			$4s(^2S)15d$	$15d\ ^3D$	1, 2, 3	48762. 4		
$3d(^2D)5s$	$5s'\ ^3D$	1	47456. 1			$4s(^2S)16d$	$16d\ ^3D$	1, 2, 3	48830. 7		
		2	47465. 9	9. 8		Ca II $(^2S_{½})$	Limit	-------	49304. 80		
		3	47475. 7	9. 8		$3d(^2D)5p$	$5p'\ ^3F°$	2	51235. 2:	24. 3	
$4s(^2S)8f$	$8f\ ^3F°$	2, 3, 4	47550. 11					3	51259. 5:		
$4s(^2S)8f$	$8f\ ^1F°$	3	47554. 97					4	51318. 7:	59. 2	
$4s(^2S)10p$	$10p\ ^1P°$	1	47660. 8			$3d(^2D)4d$	$4d'\ ^3D$	1	51351. 1	18. 5	
$4s(^2S)9d$	$9d\ ^3D$	1	47753. 3					2	51369. 6		
		2	47757. 5	4. 2				3	51395. 5	25. 9	
		3	47765. 5	8. 0		$3d(^2D)4d$	$4d'\ ^3G$	3	51553. 6:	25. 4	
$4s(^2S)11s$	$11s\ ^3S$	1	47805. 85					4	51579. 0:		
								5	51611. 5:	31. 5	
$4s(^2S)11s$	$11s\ ^1S$	0	47843. 1			$3d(^2D)4d$	$4d'\ ^3S$	1	51571. 4		
$4s(^2S)9f$	$9f\ ^3F°$	2, 3, 4	47922. 2			$3d(^2D)5p$	$5p'\ ^3D°$	1	51710. 9	23. 1	
$4s(^2S)9f$	$9f\ ^1F°$	3	47924. 9					2	51734. 0		
								3	51766. 5	32. 5	
$4s(^2S)11p$	$11p\ ^1P°$	1	47998. 6			$3d(^2D)4d$	$4d'\ ^3F$	2	53214. 6	33. 3	
$4s(^2S)10d$	$10d\ ^3D$	1	48032. 0					3	53247. 9		
		2	48033. 5	1. 5				4	53260. 4	12. 5	
		3	48036. 2	2. 7		$3d(^2D)4d$	$4d'\ ^3P$	0	54282. 2	5. 8	
$4s(^2S)12s$	$12s\ ^3S$	1	48103. 89					1	54288. 0		
								2	54304. 2	16. 2	
$4s(^2S)12s$	$12s\ ^1S$	0	48128. 2			$3d(^2D)5d$	$5d'\ ^3D$	1	56444. 8	24. 3	
$4s(^2S)10f$	$10f\ ^3F°$	2, 3, 4	48186. 61					2	56469. 1		
								3	56494. 7	25. 6	
$4s(^2S)10f$	$10f\ ^1F°$	3	48188. 3			$3d(^2D)5d$	$5d'\ ^3G$	3	56526. 3:	20. 3	
$4s(^2S)12p$	$12p\ ^1P°$	1	48222. 9					4	56546. 6:		
								5	56578. 2:	31. 6	
$4s(^2S)11d$	$11d\ ^3D$	1, 2, 3	48259. 2			$3d(^2D)5d$	$5d'\ ^3S$	1	56558. 8		
$4s(^2S)13s$	$13s\ ^3S$	1	48320. 4			$3d(^2D)5d$	$5d'\ ^3F$	2	56900. 7:	23. 4	
$4s(^2S)11f$	$11f\ ^3F°$	2, 3, 4	48382. 90					3	56924. 1:		
								4	56979. 5:	55. 4	
$4s(^2S)11f$	$11f\ ^1F°$	3	48385. 5			$3d(^2D)5d$	$5d'\ ^3P$	0	57601. 0	16. 8	
$4s(^2S)13p$	$13p\ ^1P°$	1	48416. 0					1	57617. 8		
								2	57638. 2	20. 4	
$4s(^2S)12d$	$12d\ ^3D$	1, 2, 3	48434. 8			$3d(^2D)6d$	$6d'\ ^3P$	0			
$4s(^2S)14s$	$14s\ ^3S$	1	48484. 7					1	59366. 8:	25. 2	
$3d^2$	$3d^2\ ^3P$	0	48524. 130	13. 543				2	59392. 0:		
		1	48537. 673	25. 957							
		2	48563. 630								

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Ca I Observed Terms*

Config. 1s² 2s² 2p⁶ 3s² 3p⁶+	Observed Terms			
4s²	4s² ¹S			
3d²		3d² ³P		
4p²	{ 4p² ¹S	4p² ³P	4p² ¹D	

	ns (n≥5)	np (n≥4)		
4s(²S)nx	{ 5–14s ³S 5–12s ¹S	4– 7p ³P° 4–13p ¹P°		
3d(²D)nx'	{ 5s' ³D	4p' ³P° 4p' ¹P°	4, 5p' ³D° 4p' ¹D°	4, 5p' ³F° 4p' ¹F°

	nd (n≥3)	nf (n≥4)
4s(²S)nx	{ 3–16d ³D 3– 7d ¹D	4–13f ³F° 4–11f ¹F°
3d(²D)nx'	4, 5d' ³S 4–6d' ³P 4, 5d' ³D 4, 5d' ³F 4, 5d' ³G	

*For predicted terms in the spectra of the Ca I isoelectronic sequence, see Introduction.

Ca II

(K I sequence; 19 electrons)   Z=20

Ground state 1s² 2s² 2p⁶ 3s² 3p⁶ 4s ²S$_{1/2}$

4s ²S$_{1/2}$ 95748.0 cm⁻¹   I. P. 11.87 volts

The analysis is chiefly from the paper by Saunders and Russell, who extended the earlier work on this spectrum. Their estimated value of 5g ²G is entered in brackets. The terms nd ²D (n=11 to 16) and nf ²F° (n=8 to 10) have been added from an unpublished manuscript by Shenstone who made additional observations in the region between 2897 A and 3758 A. Shenstone has also generously furnished his recent unpublished observations of the pair of lines at 8927.34 A and 8912.10 A, having intensities 20 and 15, respectively, and classified as 4d ²D—4f ²F°. These lines have been used to calculate the value of 4f ²F° listed in the table.

The three-place entries are quoted from Wagman's paper. They are derived from his observations made with the interferometer. The writer has made slight adjustments in the rest of the term values in order to fit the various sets of observations together.

A monograph on this spectrum is needed.

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H. E. White, *Introduction to Atomic Spectra*, p. 97 (McGraw-Hill Book Co., Inc., New York, N. Y., 1934). (E D)
N. E. Wagman, Univ. Pittsburgh Bul. 34, 1 (1937).   (T) (C L)
A. G. Shenstone, unpublished material (1930, 1946).   (T) (C L)

Ca II

Ca II

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3p^6(^1S)4s$	$4s\ ^2S$	½	0. 00		$3p^6(^1S)7g$	$7g\ ^2G$	3½ 4½ }	86780. 9	
$3p^6(^1S)3d$	$3d\ ^2D$	1½ 2½	13650. 212 13710. 901	60. 689	$3p^6(^1S)8d$	$8d\ ^2D$	1½ 2½	87674. 0 87675. 7	1. 7
$3p^6(^1S)4p$	$4p\ ^2P°$	½ 1½	25191. 541 25414. 427	222. 886	$3p^6(^1S)8f$	$8f\ ^2F°$	2½ 3½ }	88847. 6	
$3p^6(^1S)5s$	$5s\ ^2S$	½	52166. 982		$3p^6(^1S)8g$	$8g\ ^2G$	3½ 4½ }	88883. 8	
$3p^6(^1S)4d$	$4d\ ^2D$	1½ 2½	56839. 309 56858. 511	19. 202	$3p^6(^1S)9d$	$9d\ ^2D$	1½ 2½	89489. 8 89490. 8	1. 0
$3p^6(^1S)5p$	$5p\ ^2P°$	½ 1½	60535. 0 60613. 2	78. 2	$3p^6(^1S)9f$	$9f\ ^2F°$	2½ 3½ }	90300. 0	
$3p^6(^1S)4f$	$4f\ ^2F°$	2½ 3½ }	68056. 96		$3p^6(^1S)9g$	$9g\ ^2G$	3½ 4½ }	90326. 4	
$3p^6(^1S)6s$	$6s\ ^2S$	½	70677. 61		$3p^6(^1S)10d$	$10d\ ^2D$	1½ 2½	90755. 3 90756. 1	0. 8
$3p^6(^1S)5d$	$5d\ ^2D$	1½ 2½	72722. 11 72730. 77	8. 66	$3p^6(^1S)10f$	$10f\ ^2F°$	2½ 3½ }	91338. 0	
$3p^6(^1S)6p$	$6p\ ^2P°$	½ 1½	74485. 8 74521. 7	35. 9	$3p^6(^1S)11d$	$11d\ ^2D$	1½ 2½ }	91674. 0	
$3p^6(^1S)5f$	$5f\ ^2F°$	2½ 3½ }	78027. 8		$3p^6(^1S)12d$	$12d\ ^2D$	1½ 2½ }	92360. 9	
$3p^6(^1S)5g$	$5g\ ^2G$	3½ 4½ }	[78163]		$3p^6(^1S)13d$	$13d\ ^2D$	1½ 2½ }	92885. 0	
$3p^6(^1S)7s$	$7s\ ^2S$	½	79449. 9		$3p^6(^1S)14d$	$14d\ ^2D$	1½ 2½ }	93299. 6	
$3p^6(^1S)6d$	$6d\ ^2D$	1½ 2½	80523. 47 80528. 06	4. 59	$3p^6(^1S)15d$	$15d\ ^2D$	1½ 2½ }	93628. 8	
$3p^6(^1S)6f$	$6f\ ^2F°$	2½ 3½ }	83458. 4		$3p^6(^1S)16d$	$16d\ ^2D$	1½ 2½ }	93896. 4	
$3p^6(^1S)6g$	$6g\ ^2G$	3½ 4½ }	83540. 0						
$3p^6(^1S)8s$	$8s\ ^2S$	½	84302. 6		Ca III ($^1S_0$)	Limit	-------	95748.0	
$3p^6(^1S)7d$	$7d\ ^2D$	1½ 2½	84935. 4 84938. 3	2. 9					
$3p^6(^1S)7f$	$7f\ ^2F°$	2½ 3½ }	86727. 5						

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Ca III

(A I sequence; 18 electrons) $\qquad\qquad$ Z=20

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\ ^1S_0$

$3p^6\ ^1S_0$ **413127** cm^{-1} $\qquad\qquad$ I. P. 51.21 volts

This spectrum is incompletely analyzed. The present list has been compiled from the paper by Bowen, who has classified 137 lines in the region between 403 A and 4081 A.

The Paschen notation as given by Bowen is entered in column one of the table, under the heading "A I". Bowen remarks, however, that these assignments are in many cases doubtful for levels having the $3d$ configuration. The writer has, nevertheless, adopted them tentatively in order to introduce the jl-coupling notation in the general form suggested by Racah, as in the case of all spectra like A I. The pairs $nd[3\frac{1}{2}]°$ and $nd[1\frac{1}{2}]°$ are partially inverted as compared with Ne I.

The LS-designations $ns\ ^3P°_{210}\ ^1P°_1$ can probably be safely assigned to the levels ns_5, ns_4, ns_3, ns_2, respectively.

REFERENCE

I. S. Bowen, Phys. Rev. **31**, 499 (1928). (I P) (T) (C L)

Ca III

A I	Bowen	Config.	Desig.	J	Level	A I	Bowen	Config.	Desig.	J	Level
$1p_0$	$3p$	$3p^6$	$3p^6$ ^1S	0	0. 0	$2p_5$	$4p_5$	$3p^5(^2P°_{1\frac{1}{2}})4p$	$4p$ [½]	0	282072
		$3p^5(^2P°_{1\frac{1}{2}})3d$	$3d$ [½]°	0		$2p_4$	$4p_4$	$3p^5(^2P°_{\frac{1}{2}})4p$	$4p'$ [1½]	1	281136. 3
$3d_5$	$3D_1$			1	*203845. 1*	$2p_3$	$4p_3$			2	281878. 8
$3d_4$	$3D_3$	"	$3d$ [3½]°	4		$2p_2$	$4p_2$	"	$4p'$ [½]	1	282568. 4
				3	*213378. 3*					0	
$3d_3$	$3D_2$	"	$3d$ [1½]°	2	*204835. 4*			$3p^5(^2P°_{1\frac{1}{2}})4d$	$4d$ [½]°	0	
$3d_2$	$3D_5$			1	*224552. 4*	$4d_5$	$4D_1$			1	*322998. 9*
$3d''_1$	$3D_4$	"	$3d$ [2½]°	2	*214332. 3*			"	$4d$ [3½]°	4	
				3		$4d_4$	$4D_3$			3	*326182*
$3s'''_1$	$3D_6$	$3p^5(^2P°_{\frac{1}{2}})3d$	$3d'$ [2½]°	2	*225823. 2*	$4d_3$	$4D_2$	"	$4d$ [1½]°	2	*323650. 6*
$3s'''_1$	$3D_8$			3	*228411. 6*					1	
$3s''_1$	$3D_7$	"	$3d'$ [1½]°	2	*227387. 8*	$4d''_1$	$4D_4$	"	$4d$ [2½]°	2	*328086. 5*
$3s_1$	$3D_9$			1	*232831. 4*					3	
$1s_5$	$4s_5$	$3p^5(^2P°_{1\frac{1}{2}})4s$	$4s$ [1½]°	2	*242543. 5*	$4s'''_1$	$4D_5$	$3p^5(^2P°_{\frac{1}{2}})4d$	$4d'$ [2½]°	2	*335285. 9*
$1s_4$	$4s_4$			1	*243927. 0*					3	
$1s_3$	$4s_3$	$3p^5(^2P°_{\frac{1}{2}})4s$	$4s'$ [½]°	0	*245608. 4*	$2s_5$	$5s_5$	$3p^5(^2P°_{1\frac{1}{2}})5s$	$5s$ [1½]°	2	*327917*
$1s_2$	$4s_2$			1	*247693. 4*	$2s_4$	$5s_4$			1	*328580. 4*
$2p_{10}$	$4p_{10}$	$3p^5(^2P°_{1\frac{1}{2}})4p$	$4p$ [½]	1	272185. 4	$2s_3$	$5s_3$	$3p^5(^2P°_{\frac{1}{2}})5s$	$5s'$ [½]°	0	*331042. 7*
$2p_9$	$4p_9$	"	$4p$ [2½]	3	277018. 8	$2s_2$	$5s_2$			1	*331398. 6*
$2p_8$	$4p_8$			2	277377. 5						
								Ca IV ($^2P°_{1\frac{1}{2}}$)	*Limit*	-------	**413127**
$2p_7$	$4p_7$	"	$4p$ [1½]	1	278616. 7						
$2p_6$	$4p_6$			2	279738. 2			Ca IV ($^2P°_{\frac{1}{2}}$)	*Limit*	-------	*416261*

May 1948.

Ca III Observed Levels*

Config. $1s^2\ 2s^2\ 2p^6\ 3s^2+$	Observed Terms		
$3p^6$	$3p^6$ ¹S		
	$ns\ (n \geq 4)$		
$3p^5(^2P°)nx$	$\left\{\begin{array}{l} 4,\ 5s\ \ ^3P° \\ 4,\ 5s\ \ ^1P° \end{array}\right.$		

jl-Coupling Notation

	Observed Levels		
	$ns\ (n \geq 4)$	$np\ (n \geq 4)$	$nd\ (n \geq 3)$
$3p^5(^2P°_{1\frac{1}{2}})nx$	4, 5s [1½]°	4p [½] 4p [2½] 4p [1½]	3, 4d [½]° 3, 4d [3½]° 3, 4d [1½]° 3, 4d [2½]°
$3p^5(^2P°_{\frac{1}{2}})nx'$	4, 5s'[½]°	4p'[1½] 4p'[½]	3, 4d'[2½]° 3d'[1½]°

*For predicted levels in the spectra of the A I isoelectronic sequence, see Introduction.

Ca IV

(Cl I sequence; 17 electrons) $Z=20$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5\ ^2P°_{1\frac{1}{2}}$

$3p^5\ ^2P°_{1\frac{1}{2}}$ *542000* cm⁻¹   I. P. 67 volts

    Various investigators disagree about the interpretation of this spectrum. Tsien has published 34 classified lines in the region between 249 A and 669 A, all but one of which are due to combinations from the ground term. His terms are listed except for $4s\ ^4P$, $4s\ ^2P$, and $4s'\ ^2D$, which are from the paper by Kruger and Phillips. Further study of this spectrum is desirable to confirm the present analysis.

    The limit (entered in brackets in the table) is from Edlén, who has estimated it by extrapolation along the isoelectronic sequence.

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I. S. Bowen, Phys. Rev. **31**, 498 (1928). (C L)
B. Edlén, Zeit. Phys. **104**, 410 (1947). (I P)
P. G. Kruger and L. W. Phillips, Phys. Rev. **51**, 1087 (1937). (T) (C L)
W.–Z. Tsien, Chinese J. Phys. **3**, No. 2, 118 (1939). (T) (C L)

Ca IV

Config.	Desig.	J	Level	Interval
$3s^2\,3p^5$	$3p^5\ ^2P^\circ$	$1\tfrac12$ $\tfrac12$	*0* *3115*	−3115
$3s\,3p^6$	$3p^6\ ^2S$	$\tfrac12$	152430	
$3s^2\,3p^4(^3P)3d$	$3d\ ^4F$	$4\tfrac12$ $3\tfrac12$ $2\tfrac12$ $1\tfrac12$	221944	
$3s^2\,3p^4(^3P)3d$	$3d\ ^4D$	$3\tfrac12$ $2\tfrac12$ $1\tfrac12$ $\tfrac12$	227427 227827 228691	−400 −864
$3s^2\,3p^4(^3P)3d$	$3d\ ^2D$	$1\tfrac12$ $2\tfrac12$	228429 230113	1684
$3s^2\,3p^4(^3P)3d$	$3d\ ^2F$	$3\tfrac12$ $2\tfrac12$	266840	
$3s^2\,3p^4(^3P)4s$	$4s\ ^4P$	$2\tfrac12$ $1\tfrac12$ $\tfrac12$	291373 293011 294291	−1638 −1280

Ca IV

Config.	Desig.	J	Level	Interval
$3s^2\,3p^4(^3P)4s$	$4s\ ^2P$	$1\tfrac12$ $\tfrac12$	298175 300249	−2074
$3s^2\,3p^4(^1D)3d$	$3d'\ ^2D$	$2\tfrac12$ $1\tfrac12$	303591	
$3s^2\,3p^4(^1D)3d$	$3d'\ ^2S$	$\tfrac12$	303844	
$3s^2\,3p^4(^1D)4s$	$4s'\ ^2D$	$1\tfrac12$ $2\tfrac12$	314079 314373	294
$3s^2\,3p^4(^3P)4p$	$4p\ ^2P^\circ$	$1\tfrac12$ $\tfrac12$	*329277*	
$3s^2\,3p^4(^1S)4s$	$4s''\ ^2S$	$\tfrac12$	337207	
$3s^2\,3p^4(^1D)5s$	$5s'\ ^2D$	$2\tfrac12$ $1\tfrac12$	399755 400949	−1194
Ca v $(3p^4\ ^3P_2)$	*Limit*		*[542000]*	

March 1948.

Ca IV Observed Terms*

Config. $1s^2\,2s^2\,2p^6$	Observed Terms		
$3s^2\,3p^5$	$3p^5\ ^2P^\circ$		
$3s\,3p^6$	$3p^6\ ^2S$		
	$ns\ (n\ge 4)$	$np\ (n\ge 4)$	$nd\ (n\ge 3)$
$3s^2\,3p^4(^3P)nx$ {	$4s\ ^4P$ $4s\ ^2P$	$4p\ ^2P^\circ$	$3d\ ^4D$ $3d\ ^4F$ $3d\ ^2D$ $3d\ ^2F$
$3s^2\,3p^4(^1D)nx'$	4, $5s'\ ^2D$		$3d'\ ^2S$ $3d^{\cdot}\ ^2D$
$3s^2\,3p^4(^1S)nx''$	$4s''\ ^2S$		

*For predicted terms in the spectra of the Cl i isoelectronic sequence, see Introduction.

Ca V

(S i sequence; 16 electrons) $Z=20$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^4\ ^3P_2$

$3p^4\ ^3P_2$ **680800** cm^{-1} I. P. 84.39 volts

The terms are from the papers by Bowen and by Tsien with the revised value of $3p^5\ ^1P^\circ$ suggested by Edlén.

More than 70 lines have been classified in the interval 184 A to 656 A. Intersystem combinations connecting the singlet and triplet terms have been observed.

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B. Edlén, Zeit. Phys. **104**, 192 (1937). (I P)
W.–Z. Tsien, Chinese J. Phys. **3**, No. 2, 131 (1939). (T) (C L)
B. Edlén, Phys. Rev. **62**, 434 (1942). (T) (C L)

Ca V

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^4$	$3p^4\ ^3P$	2 1 0	0 2404 3276	−2404 −872	$3s^2\,3p^3(^2D°)4s$	$4s'\ ^3D°$	1 2 3	369590 369696 369959	106 263
$3s^2\,3p^4$	$3p^4\ ^1D$	2	18831		$3s^2\,3p^3(^2D°)4s$	$4s'\ ^1D°$	2	374728	
$3s^2\,3p^4$	$3p^4\ ^1S$	0	43847		$3s^2\,3p^3(^2P°)4s$	$4s''\ ^3P°$	0 1 2	387039 387226 387652	187 426
$3s\,3p^5$	$3p^5\ ^3P°$	2 1 0	154664 156756 157897	−2092 −1141	$3s^2\,3p^3(^2P°)4s$	$4s''\ ^1P°$	1	392283	
$3s\,3p^5$	$3p^5\ ^1P°$	1	197849		$3s^2\,3p^3(^4S°)5s$	$5s\ ^3S°$	1	501127	
$3s^2\,3p^3(^2D°)3d$	$3d'\ ^1F°$	3	254125		$3s^2\,3p^3(^2D°)5s$	$5s'\ ^3D°$	1 2 3	524651 524770 525053	119 283
$3s^2\,3p^3(^2P°)3d$	$3d''\ ^3P°$	2 1 0	298204 299535	−1331	$3s^2\,3p^3(^2D°)5s$	$5s'\ ^1D°$	2	526523	
$3s^2\,3p^3(^2P°)3d$	$3d''\ ^1P°$	1	302184		$3s^2\,3p^3(^2P°)5s$	$5s''\ ^3P°$	0 1 2	 542249 542650	401
$3s^2\,3p^3(^2P°)3d$	$3d''\ ^3D°$	3 2 1	 309834 310945	−1111	$3s^2\,3p^3(^2P°)5s$	$5s''\ ^1P°$	1	544143	
$3s^2\,3p^3(^2P°)3d$	$3d''\ ^1D°$	2	329230						
$3s^2\,3p^3(^4S°)4s$	$4s\ ^3S°$	1	350914		Ca VI $(^4S^°_{1\frac{1}{2}})$	*Limit*		**680800**	

December 1947.

Ca V Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2\,3p^4$	$3p^4\ ^1S$ $3p^4\ ^3P$ $3p^4\ ^1D$		
$3s\,3p^5$	$3p^5\ ^3P°$ $3p^5\ ^1P°$		
	$ns\ (n \ge 4)$		$nd\ (n \ge 3)$
$3s^2\,3p^3(^4S°)nx$	4, 5s $^3S°$		
$3s^2\,3p^3(^2D°)nx'$	4, 5s' $^3D°$ 4, 5s' $^1D°$		$3d'\ ^1F°$
$3s^2\,3p^3(^2P°)nx''$	4, 5s'' $^3P°$ 4, 5s'' $^1P°$	$3d''\ ^3P°$ $3d''\ ^3D°$ $3d''\ ^1P°$ $3d''\ ^1D°$	

*For predicted terms in the spectra of the S I isoelectronic sequence, see Introduction.

Ca VI

(P I sequence; 15 electrons) $Z=20$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$3p^3\ {}^4S^\circ_{1\frac{1}{2}}$ cm^{-1} I. P.   volts

The terms are from the paper by Tsien, who includes those given earlier by Bowen. Fifty-three lines have been classified in the interval between 228 A and 766 A. For the term $3p^4\ {}^2P$ the value given by Mrs. Beckman is quoted in place of that by Tsien.

The relative positions of the doublet and quartet systems of terms were estimated from the irregular doublet law. No intersystem combinations have been observed, as indicated by the uncertainty x in the table and the brackets around $3p^3\ {}^2D^\circ_{1\frac{1}{2}}$.

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W.–Z. Tsien, Chinese J. Phys. **3**, No. 2, 136 (1939).   (T) (C L)

Ca VI

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^3$	$3p^3\ {}^4S^\circ$	$1\frac{1}{2}$	0			3		$303651+x$	
$3s^2\,3p^3$	$3p^3\ {}^2D^\circ$	$1\frac{1}{2}$	$[27000]+x$	417	$3s^2\,3p^2({}^1D)3d$	$3d'\ {}^2S$	$\frac{1}{2}$	$320397+x$	
		$2\frac{1}{2}$	$27417+x$		$3s^2\,3p^2({}^1D)3d$	$3d'\ {}^2D$	$2\frac{1}{2}$	$321084+x$	-500
$3s^2\,3p^3$	$3p^3\ {}^2P^\circ$	$\frac{1}{2}$	$44754+x$	556			$1\frac{1}{2}$	$321584+x$	
		$1\frac{1}{2}$	$45310+x$		$3s^2\,3p^2({}^1D)3d$	$3d'\ {}^2P$	$\frac{1}{2}$	$332138+x$	1354
$3s\,3p^4$	$3p^4\ {}^4P$	$2\frac{1}{2}$	155792	-1983			$1\frac{1}{2}$	$333492+x$	
		$1\frac{1}{2}$	157775	-1058	$3s^2\,3p^2({}^1S)3d$	$3d''\ {}^2D$	$1\frac{1}{2}$	$360821+x$	
		$\frac{1}{2}$	158833				$2\frac{1}{2}$		
	1 $({}^2D)$	$2\frac{1}{2}$	$175758+x$	-399	$3s^2\,3p^2({}^3P)3d$	$3d\ {}^2D$	$2\frac{1}{2}$		
	2	$1\frac{1}{2}$	$176157+x$				$1\frac{1}{2}$	$383743+x$	
$3s\,3p^4$	$3p^4\ {}^2D$	$1\frac{1}{2}$	$193412+x$	201	$3s^2\,3p^2({}^3P)4s$	$4s\ {}^4P$	$\frac{1}{2}$	433849	1437
		$2\frac{1}{2}$	$193613+x$				$1\frac{1}{2}$	435286	2106
$3s\,3p^4$	$3p^4\ {}^2P$	$1\frac{1}{2}$	$223170+x$				$2\frac{1}{2}$	437392	
		$\frac{1}{2}$			$3s^2\,3p^2({}^3P)4s$	$4s\ {}^2P$	$\frac{1}{2}$	$442423+x$	2467
$3s\,3p^4$	$3p^4\ {}^2S$	$\frac{1}{2}$	$231318+x$				$1\frac{1}{2}$	$444890+x$	
$3s^2\,3p^2({}^3P)3d$	$3d\ {}^2F$	$2\frac{1}{2}$	$291165+x$		$3s^2\,3p^2({}^1D)4s$	$4s'\ {}^2D$	$2\frac{1}{2}$	$457458+x$	-67
		$3\frac{1}{2}$					$1\frac{1}{2}$	$457525+x$	
$3s^2\,3p^2({}^3P)3d$	$3d\ {}^2P$	$1\frac{1}{2}$	$294798+x$	-2452					
		$\frac{1}{2}$	$297250+x$						

November 1947.

Ca VI Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2\,3p^3$	$\begin{cases}3p^3\ ^4S°\\ \end{cases}$ $3p^3\ ^2P°$ $\quad 3p^3\ ^2D°$		
$3s\,3p^4$	$\begin{cases} \\ 3p^4\ ^2S\end{cases}$ $\begin{matrix}3p^4\ ^4P\\ 3p^4\ ^2P\end{matrix}$ $\quad 3p^4\ ^2D$		
		$ns\ (n\geq 4)$	$nd\ (n\geq 3)$
$3s^2\,3p^2(^3P)nx$	$\begin{cases} \\ \ \end{cases}$	$\begin{matrix}4s\ ^4P\\ 4s\ ^2P\end{matrix}$	$3d'\ ^2P\quad 3d\ \ ^2D\quad 3d\ ^2F$
$3s^2\,3p^2(^1D)nx'$		$4s'\ \ ^2D$	$3d'\ ^2S\quad 3d'\ ^2P\quad 3d'\ ^2D$
$3s^2\,3p^2(^1S)nx''$			$3d''\ ^2D$

*For predicted terms in the spectra of the P I isoelectronic sequence, see Introduction.

Ca VII

(Si I sequence; 14 electrons) $\hspace{6cm}$ $Z=20$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^2\ ^3P_0$

$3p^2\ ^3P_0\ \mathbf{1030000}\ \mathrm{cm}^{-1}$ $\hspace{6cm}$ I. P. 128 volts

The terms are from the paper by Phillips, who includes those found by Whitford and by Robinson. In the interval between 202 A and 640 A, 33 lines have been classified in all. Intersystem combinations connecting the singlet and triplet terms have been observed.

The limit entered in brackets in the table has been estimated by Phillips.

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A. E. Whitford, Phys. Rev. 46, 793 (1934). (T) (C L)
H. A. Robinson, Phys. Rev. 52, 725 (1937). (T) (C L)
L. W. Phillips, Phys. Rev. 55, 708 (1939). (I P) (T) (C L)

Ca VII $\hspace{12cm}$ Ca VII

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^2$	$3p^2\ ^3P$	0 1 2	0 1627 4070	1627 2443	$3s^2\,3p(^2P°)3d$	$3d\ ^3P°$	2 1 0	286232 288169 289011	−1937 −842
$3s^2\,3p^2$	$3p^2\ ^1D$	2	21870		$3s^2\,3p(^2P°)3d$	$3d\ ^3D°$	1 2 3	302663 303151 303349	488 198
$3s\,3p^3$	$3p^3\ ^3D°$	1 2 3	160160 160228 160527	68 299	$3s^2\,3p(^2P°)4s$	$4s\ ^3P°$	0 1 2	490012 490918 494264	906 3346
$3s\,3p^3$	$3p^3\ ^3P°$	2, 1, 0	185405						
$3s\,3p^3$	$3p^3\ ^3S°$	1	245232						
$3s\,3p^3$	$3p^3\ ^1P°$	1	252493		Ca VIII ($^2P°_{3/2}$)	**Limit**		[1030000]	

October 1947.

Ca VIII

(Al I sequence; 13 electrons) $Z=20$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\;{}^2P^\circ_{\frac{1}{2}}$

$3p\;{}^2P^\circ_{\frac{1}{2}}$ *1189000* cm^{-1} I. P. 147 volts

The analysis is by Whitford and by Phillips. Thirty-five lines have been classified in the interval between 114 A and 596 A. No intersystem combinations have been observed, but Phillips estimates that $3p^2\;{}^4P_{\frac{1}{2}}$ is approximately 128000 cm^{-1} above the ground state. This value is entered in brackets in the table. The uncertainty x may exceed ±1000 cm^{-1}.

Using the method suggested by Edlén, the writer has extrapolated the value of the limit quoted above and entered in brackets in the table. The uncertainty in this estimate is large owing to the incompleteness of the isoelectronic sequence data.

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A. E. Whitford, Phys. Rev. **46**, 793 (1934). (T) (C L)
L. W. Phillips, Phys. Rev. **55**, 708 (1939). (T) (C L)

Ca VIII

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$3p\ ^2P^\circ$	½ 1½	*0* *4305*	4305	$3s\ 3p(^3P^\circ)3d$	$3d\ ^4D^\circ$	½ 1½ 2½ 3½	*410725 +x* *411283 +x* *411664 +x* *411782 +x*	558 381 118
$3s\ 3p^2$	$3p^2\ ^4P$	½ 1½ 2½	[128000]+x 129581 +x 131942 +x	1581 2361	$3s^2(^1S)4s$	$4s\ ^2S$	½	547308	
$3s\ 3p^2$	$3p^2\ ^2D$	1½ 2½	171573 171828	255	$3s\ 3p(^3P^\circ)4s$	$4s\ ^4P^\circ$	½ 1½ 2½	*687650 +x* *689017 +x* *691726 +x*	1367 2709
$3s\ 3p^2$	$3p^2\ ^2S$	½	216590		$3s^2(^1S)4d$	$4d\ ^2D$	1½ 2½	697981 698172	191
$3s\ 3p^2$	$3p^2\ ^2P$	½ 1½	231012 233584	2572	$3s^2(^1S)5d$	$5d\ ^2D$	1½ 2½	872860 873070	210
$3s^2(^1S)3d$	$3d\ ^2D$	1½ 2½	282362 282574	212					
$3p^3$	$3p^3\ ^4S^\circ$	1½	*344176 +x*		Ca IV ($^1S_0$)	Limit		[1189000]	

September 1947.

Ca VIII Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2(^1S)3p$		$3p\ ^2P^\circ$	
$3s\ 3p^2$	$3p^2\ ^2S$	$3p^2\ ^4P$ $3p^2\ ^2P$	$3p^2\ ^2D$
$3p^3$	$3p^3\ ^4S^\circ$		
		$ns\ (n\geq4)$	$nd\ (n\geq3)$
$3s^2(^1S)nx$		$4s\ ^2S$	$3\text{–}5d\ ^2D$
$3s\ 3p(^3P^\circ)nx$		$4s\ ^4P^\circ$	$3d\ ^4D^\circ$

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

Ca IX

(Mg I sequence; 12 electrons)   Z=20

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,{}^1S_0$

$3s^2\,{}^1S_0$ **1519000$\pm$** cm^{-1} I. P. 188$\pm$ volts

Twenty-eight lines have been classified in the range between 100 A and 828 A. The triplet terms are from Parker and Phillips; the singlets from Tsien. By extrapolation along the sequence, Mrs. Beckman has classified a line at 693.824 A as the intersystem combination $3s^2\,{}^1S_0-3p\,{}^3P_1^\circ$. The listed values of the triplet terms have been adjusted to fit this assignment.

From isoelectronic sequence data, the writer has extrapolated the value of the limit, using the method suggested by Edlén. This value is entered in brackets in the table. Although this estimate may be in error by more than ±1000 cm^{-1}, it gives an approximate value of the ionization potential.

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W.–Z. Tsien, Chinese J. Phys. **3**, No. 2, 142 (1939). (T) (C L)

W. L. Parker and L. W. Phillips, Phys. Rev. **57**, 140 (1940). (T) (C L)

Ca IX

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\,{}^1S$	0	0		$3s({}^2S)4s$	$4s\,{}^3S$	1	760002	
$3s({}^2S)3p$	$3p\,{}^3P^\circ$	0	*142635*		$3s({}^2S)4d$	$4d\,{}^3D$	1	916652	
		1	*144130*	1495			2	916780	128
		2	*147370*	3240			3	916990	210
$3s({}^2S)3p$	$3p\,{}^1P^\circ$	1	*214487. 8*		$3s({}^2S)4f$	$4f\,{}^3F^\circ$	2	*954003*	
$3s({}^2S)3d$	$3d\,{}^1D$	2	335195. 0				3	*954023*	20
							4	*954055*	32
$3p^2$	$3p^2\,{}^3P$	0	339420		$3s({}^2S)5d$	$5d\,{}^3D$	1		
		1	341333	1913			2	1137720	
		2	344935	3602			3	1137880	160
$3s({}^2S)3d$	$3d\,{}^3D$	1	411525						
		2	411652	127	Ca X $({}^2S_{1/2})$	*Limit*	-------	[1519000]	
		3	411858	206					

March 1948.

Ca X

(Na I sequence; 11 electrons) $Z=20$

Ground state $1s^2\, 2s^2\, 2p^6\, 3s\ {}^2S_{1/2}$

$3s\ {}^2S_{1/2}$ **1704660** cm^{-1} I. P. 211.29 volts

Kruger and Phillips extended the earlier analysis by Edlén. Their absolute term values are derived from three members of the ^{2}D-series. One term, $5s\,{}^2$S has been added from the work of Tsien but adjusted to agree with those by Kruger and Phillips.

Twenty-two lines have been classified in the range from 93 A to 574 A.

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W.–Z. Tsien, Chinese J. Phys **3,** No. 2, 145 (1939).   (T) (C L)
P. G. Kruger and L. W. Phillips, Phys. Rev. **55,** 352 (1939).   (I P) (T) (C L)

Ca X

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
3s	3s ^{2}S	½	0		4f	4f ^{2}F°	2½	*1016113*	95
							3½	*1016208*	
3p	3p ^{2}P°	½	*174214*	5081	5s	5s ^{2}S	½	1170098	
		1½	*179295*						
3d	3d ^{2}D	1½	417113	414	5d	5d ^{2}D	1½	1248686	105
		2½	417527				2½	1248791	
4s	4s ^{2}S	½	832838		5f	5f ^{2}F°	2½	*1263323*	60
							3½	*1263383*	
4p	4p ^{2}P°	½	*899305*	1905	6f	6f ^{2}F°	2½		
		1½	*901210*				3½	*1398140*	
4d	4d ^{2}D	1½	987259	225					
		2½	987484		Ca XI (^{1}S$_0$)	*Limit*		**1704660**	

June 1947.

Ca XI

(Ne I sequence; 10 electrons) $Z=20$

Ground state $1s^2\, 2s^2\, 2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ **4774300** cm^{-1} I. P. 591.8 volts

Eleven lines between 25 A and 35 A have been classified by Edlén and Tyrén as combinations with the ground term. Their absolute term values have been extrapolated along the Ne I isoelectronic sequence.

By analogy with Ne I, the *jl*-coupling notation in the general form suggested by Racah is introduced.

The unit adopted by Edlén and Tyrén, 10^3 cm^{-1}, has here been changed to cm^{-1}.

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G. Racah, Phys. Rev **61,** 537 (L) (1942).

Ca XI

Authors	Config.	Desig.	J	Level
$2p$ $^1S_0$	$2s^2\,2p^6$	$2p^6$ ^1S	0	0
$3s$ $^3P_1$	$2s^2\,2p^5(^2P^o_{1\frac{1}{2}})3s$	$3s$ $[1\frac{1}{2}]^o$	2 1	2810900
$3s$ $^1P_1$	$2s^2\,2p^5(^2P^o_{\frac{1}{2}})3s$	$3s'$ $[\,\frac{1}{2}]^o$	0 1	2839900
$3d$ $^3P_1$	$2s^2\,2p^5(^2P^o_{1\frac{1}{2}})3d$	$3d$ $[\,\frac{1}{2}]^o$	0 1	3199300
$3d$ $^1P_1$	"	$3d$ $[1\frac{1}{2}]^o$	1	3239700
$3d$ $^3D_1$	$2s^2\,2p^5(^2P^o_{\frac{1}{2}})3d$	$3d'$ $[1\frac{1}{2}]^o$	1	3284300
$3p'$ $^3P_1$	$2s\,2p^6(^2S)3p$	$3p$ $^3P^o$	2 1 0	3692900

Ca XI

Authors	Config.	Desig.	J	Level
$3p'$ $^1P_1$	$2s\,2p^6(^2S)3p$	$3p$ $^1P^o$	1	3708900
$4s$ $^3P_1$	$2s^2\,2p^5(^2P^o_{1\frac{1}{2}})4s$	$4s$ $[1\frac{1}{2}]^o$	2 1	3753900
$4s$ $^1P_1$	$2s^2\,2p^5(^2P^o_{\frac{1}{2}})4s$	$4s'$ $[\,\frac{1}{2}]^o$	0 1	3781900
$4d$ $^1P_1$	$2s^2\,2p^5(^2P^o_{1\frac{1}{2}})4d$	$4d$ $[1\frac{1}{2}]^o$	1	3919000
$4d$ $^3D_1$	$2s^2\,2p^5(^2P^o_{\frac{1}{2}})4d$	$4d'$ $[1\frac{1}{2}]^o$	1	3948400
Ca XII $(^2P^o_{1\frac{1}{2}})$	----------	Limit		4774300
Ca XII $(^2P^o_{\frac{1}{2}})$	----------	Limit		4804328

April 1947.

Ca XI Observed Levels*

Config. $1s^2+$	Observed Terms		
$2s^2\,2p^6$	$2p^6$ ^1S		
	ns $(n\geq 3)$	np $(n\geq 3)$	nd $(n\geq 3)$
$2s^2\,2p^5(^2P^o)nx$	{ 3, 4s $^3P^o$ 3, 4s $^1P^o$		3d $^3P^o$ 3, 4d $^3D^o$ 3, 4d $^1P^o$
$2s\,2p^6(^2S)nx$	{	3p $^3P^o$ 3p $^1P^o$	

	jl-Coupling Notation	
	Observed Pairs	
	ns $(n\geq 3)$	nd $(n\geq 3)$
$2s^2\,2p^5(^2P^o_{1\frac{1}{2}})nx$	3, 4s $[1\frac{1}{2}]^o$	3d $[\,\frac{1}{2}]^o$ 3, 4d $[1\frac{1}{2}]^o$
$2s^2\,2p^5(^2P^o_{\frac{1}{2}})nx'$	3, 4$s'[\,\frac{1}{2}]^o$	3, 4$d'[1\frac{1}{2}]^o$

*For predicted levels in the spectra of the Ne I isoelectronic sequence, see Introduction.

Ca XII

(F I sequence; 9 electrons) $\hspace{6cm}$ $Z=20$

Ground state $1s^2\,2s^2\,2p^5\,{}^2\mathrm{P}^\circ_{1\frac{1}{2}}$

$2p^5\,{}^2\mathrm{P}^\circ_{1\frac{1}{2}}$ $\hspace{3cm}$ cm^{-1} $\hspace{6cm}$ I. P. 655 volts

Edlén and Tyrén have classified 9 lines in the range 27 A to 32 A. They have published no term array because the analysis is so incomplete. In the 1942 paper Edlén lists the interval of the ground term as 30028 cm^{-1}, a value based on unpublished material. From these data preliminary term values have been calculated and entered in the table.

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B. Edlén and F. Tyrén, Zeit. Phys. **101**, 206 (1936). (C L)
B. Edlén, Zeit. Astroph. **22**, 59 (1942). (I P) (T)

Ca XII

Edlén	Config.	Desig.	J	Level	Interval
$2p\ {}^2\mathrm{P}_2$ ${}^2\mathrm{P}_1$	$2s^2\,2p^5$	$2p^5\ {}^2\mathrm{P}^\circ$	$1\frac{1}{2}$ $\frac{1}{2}$	0 30028	-30028
$3s\ {}^4\mathrm{P}_3$ ${}^4\mathrm{P}_2$	$2s^2\,2p^4({}^3\mathrm{P})3s$	$3s\quad {}^4\mathrm{P}$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	3062300 3077100	-14800
$3s\ {}^2\mathrm{P}_2$ ${}^2\mathrm{P}_1$	$2s^2\,2p^4({}^3\mathrm{P})3s$	$3s\quad {}^2\mathrm{P}$	$1\frac{1}{2}$ $\frac{1}{2}$	3097900	
$\overline{3s}\ {}^2\mathrm{D}_3$ ${}^2\mathrm{D}_2$	$2s^2\,2p^4({}^1\mathrm{D})3s$	$3s'\ \ {}^2\mathrm{D}$	$2\frac{1}{2}$ $1\frac{1}{2}$	3158600 3158900	-300
$\overline{3d}$	$2s^2\,2p^4({}^1\mathrm{D})3d$	$3d'\ \ \mathrm{X}$		3574200	
$\overline{\overline{3d}}\ {}^2\mathrm{D}_3$ ${}^2\mathrm{D}_2$	$2s^2\,2p^4({}^1\mathrm{S})3d$	$3d''\ {}^2\mathrm{D}$	$2\frac{1}{2}$ $1\frac{1}{2}$	3648000 3652400	-4400

March 1947.

Ca XIII

(O I sequence; 8 electrons) $Z=20$

Ground state $1s^2\,2s^2\,2p^4\,{}^3P_2$

$2p^4\,{}^3P_2$ cm^{-1} I. P.   volts

    This spectrum has not been analyzed. Edlén suggests the possibility that the line observed in the coronal spectrum at 4086.3 A (24465 cm^{-1}) may be due to the forbidden transition $2p^4\,{}^3P_2-2p^4\,{}^3P_1$ of Ca XIII. This separation for the leading components of the ground term is not inconsistent with that extrapolated along the O I isoelectronic sequence.

<div align="center">REFERENCE</div>

B. Edlén, Zeit. Astroph. **22**, 62 (1942). (T)

March 1947.

Ca XV

(C I sequence; 6 electrons) $Z=20$

Ground state $1s^2\,2s^2\,2p^2\,{}^3P_0$

$2p^2\,{}^3P_0$ cm^{-1}.   I. P.   volts

    An extrapolation of the ground term interval along the C I isoelectronic sequence indicates that the separations of the components of the ground term, $2s^2\,2p^2\,{}^3P$, should be approximately 17700 cm^{-1}, according to Edlén. He suggests that the line observed in the solar corona at 5694.42 A, wave number 17556 cm^{-1}, may tentatively be identified as [Ca XV]?, $2s^2\,2p^2\,{}^3P_0-2s^2\,2p^2\,{}^3P_1$.

<div align="center">REFERENCE</div>

B. Edlén, Zeit. Astroph. **22**, 59 (1942). (T)

March 1947

SCANDIUM

Sc I

21 electrons $Z=21$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d\,4s^2\;{}^2D_{1\frac{1}{2}}$

$a\;{}^2D_{1\frac{1}{2}}$ 52920 cm^{-1} I. P. 6.56 volts

The analysis is chiefly from the paper by Russell and Meggers with some additions from unpublished manuscript generously furnished by Russell. In the published analysis the terms $a\;{}^4P$, $y\;{}^4P°$, and $z\;{}^4S°$ were unconnected with the rest and $a\;{}^4P_{\frac{1}{2}}$ was assigned the value x. The connection is now established from observed combinations.

Similarly, the group $a\;{}^2P$, $v\;{}^2D°$, $z\;{}^2S°$ and $u\;{}^2D°$ were connected with the rest only by the relation $a\;{}^2P_{\frac{1}{2}}=y$. Ufford has predicted the relative position of $a\;{}^2P$. His estimated value, $a\;{}^2P_{\frac{1}{2}}=21400$, is entered in brackets in the table and has been added to all levels in this group of terms. The uncertainty is indicated by y since the group is not connected with the rest by observed combinations.

The two terms, $f\;{}^4P$ and $x\;{}^4D°$ have been added from the unpublished material mentioned above. The limit is also from a recalculation of the series recently made by Russell for inclusion here.

Russell and Meggers have noted that the assignment of the limit terms to the two triads $z\;{}^2P°$ $z\;{}^2D°$ $z\;{}^2F°$, $y\;{}^2P°$ $y\;{}^2D°$ $y\;{}^2F°$ is uncertain. One triad has the limit $a\;{}^3D$ in Sc II and the other, $a\;{}^1D$. Russell, in discussing the behavior of the d electrons in related spectra, concludes that the higher triad has as its limit the term of higher multiplicity. (See 1927 reference below.)

The doublet and quartet terms are connected by observed intersystem combinations.

In the 1925 paper mentioned below some observed Zeeman patterns are given. Catalán has calculated from these patterns the g-values listed in the table.

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S. Goudsmit, J. van der Mark, and P. Zeeman, Proc. Roy. Acad. Amsterdam **28**, No. 2, 127 (1925). (Z E)
H. N. Russell and W. F. Meggers, Sci. Papers Bur. Std. **22**, No. 558, 340 (1927). (I P) (T) (C L) (G D)
H. N. Russell, Astroph. J. **66**, 201 (1927); Mt. Wilson Contr. No. 341 (1927).
C. W. Ufford, unpublished material (July 1941). (T)
H. N. Russell, unpublished material (Jan. 1934, May 1948). (I P) (T) (C L)
M. A. Catalân, unpublished material (June 1948). (Z E)
W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs.)

Sc I

Config.	Desig.	J	Level	Interval	Obs. g
3d 4s²	a ²D	1½	0.00	168.34	0.79
		2½	168.34		1.20
3d²(a ³F)4s	a ⁴F	1½	11520.15	37.49	
		2½	11557.64	52.60	
		3½	11610.24	67.07	
		4½	11677.31		
3d²(a ³F)4s	a ²F	2½	14926.24	115.74	
		3½	15041.98		
3d 4s(a ³D)4p	z ⁴F°	1½	15672.55	83.96	
		2½	15756.51	125.25	
		3½	15881.76	144.76	
		4½	16026.52		
3d 4s(a ³D)4p	z ⁴D°	½	16009.71	12.07	
		1½	16021.78	119.26	
		2½	16141.04	69.76	
		3½	16210.80		
3d 4s(a ¹D)4p	z ²D°	2½	16022.72	−74.14	
		1½	16096.86		
3d²(b ¹D)4s	b ²D	2½	17012.98	−12.38	
		1½	17025.36		
3d²(a ³P)4s	a ⁴P	½	17918.85	29.13	
		1½	17947.98	52.27	
		2½	18000.25		
3d 4s(a ³D)4p	z ⁴P°	½	18504.05	11.72	
		1½	18515.77	55.63	
		2½	18571.40		
3d 4s(a ¹D)4p	z ²P°	½	18711.03	144.73	
		1½	18855.76		
3d²(a ¹G)4s	a ²G	4½	20237.10	−2.82	
		3½	20239.92		
3d 4s(a ¹D)4p	z ²F°	2½	21032.78	53.06	
		3½	21085.84		
3d²(a ³P)4s	a ²P	½	[21400]+y	80.40	
		1½	21480.40 +y		
3d 4s(a ³D)4p	y ²P°	{ ½ 1½ }	24656.80		
3d 4s(a ³D)4p	y ²D°	1½	24866.18	147.97	0.82
		2½	25014.15		1.17
3d 4s(a ͡D)4p	y ²F°	2½	25584.64	140.08	0.90
		3½	25724.72		1.14
3d²(a ³F)4p	z ⁴G°	2½	29022.87	73.33	
		3½	29096.20	93.63	
		4½	29189.83	113.69	
		5½	29303.52		
3d²(a ¹S)4p	x ²P°	½	30573.10	133.51	0.68
		1½	30706.61		
3d²(a ³F)4p	y ⁴F°	1½	31172.62	43.14	
		2½	31215.76	59.56	
		3½	31275.32	75.49	
		4½	31350.81		

Sc I

Config.	Desig.	J	Level	Interval	Obs. g
3d²(a ³F)4p	y ⁴D°	½	32637.40	21.81	
		1½	32659.21	37.63	
		2½	32696.84	54.70	
		3½	32751.54		
3d²(a ³F)4p	z ²G°	3½	33056.19	95.21	
		4½	33151.40		
3d²(a ³F)4p	x ²F°	2½	33154.01	124.63	
		3½	33278.64		
3d²(a ³F)4p	x ²D°	1½	33615.06	92.19	
		2½	33707.25		
3d³	e ⁴F	1½	33763.57	35.11	
		2½	33798.68	47.94	
		3½	33846.62	59.78	
		4½	33906.40		
3d 4s(a ³D)5s	e ⁴D	½	34390.25	32.60	
		1½	34422.85	57.20	
		2½	34480.05	87.05	
		3½	34567.10		
3d 4s(a ³D)5s	e ²D	1½	35671.00	74.57	
		2½	35745.57		
3d³:	f ²D	1½	36276.76	53.73	
		2½	36330.49		
3d³	e ⁴P	½	36492.82	22.94	
		1½	36515.76	57.04	
		2½	36572.80		
3d²(b ¹D)4p	w ²D°	1½	36934.15	105.62	
		2½	37039.77		
3d 4s(a ³D)4d	e ²P	½	37085.72	62.53	
		1½	37148.25		
3d²(b ¹D)4p	w ²P°	1½	37086.31	−39.41	
		½	37125.72		
3d²(a ³P)4p	x ⁴D°	½			
		1½	37486.48	66.86	
		2½	37553.34	163.77	
		3½	37717.11		
3d 4s(a ³D)4d	g ²D	1½	37780.83	74.67	
		2½	37855.50		
3d²(a ³P)4p	z ⁴S°	1½	38179.92		
3d²(a ³P)4p	y ⁴P°	½	38570.64	30.86	
		1½	38601.50	56.43	
		2½	38657.93		
3d 4s(a ³D)4d	e ²G	3½	38571.70	86.53	
		4½	38658.23		
3d 4s(a ³D)4d	e ²F	2½	38871.60	87.56	
		3½	38959.16		
3d²(a ¹G)4p	z ²H°	4½	39153.42	95.85	
		5½	39249.27		
3d²(a ¹G)4p	y ²G°	3½	39392.95	30.78	
		4½	39423.73		

Sc I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
3d 4s(a ³D)4d	f ⁴D	½	39701.30	20.41	
		1½	39721.71	33.22	
		2½	39754.93	44.92	
		3½	39799.85		
3d 4s(a ³D)4d	e ⁴G	2½	39861.25	41.40	
		3½	39902.65	55.06	
		4½	39957.71	70.52	
		5½	40028.23		
3d²(a ¹G)4p	w ²F°	2½	*39881.25*	7.86	
		3½	*39889.11*		
3d 4s(a ³D)4d	f ⁴F	1½	40521.21	33.77	
		2½	40554.98	49.04	
		3½	40604.02	66.85	
		4½	40670.87		
	h ²D	1½	40802.72	22.93	
		2½	40825.65		
3d 4s(a ³D)4d	f ⁴P	½	41447.02	27.86	
		1½	41474.88	30.77	
		2½	41505.65		
3d²(a ³F)5s	g ⁴F	1½	41921.94	38.92	
		2½	41960.86	54.71	
		3½	42015.57	69.44	
		4½	42085.01		

June 1948.

Sc I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
3d²(a ³P)4p:	v ²D°	1½	*43166.52+y*	54.22	
		2½	*43220.74+y*		
3d²(a ³P)4p:	z ²S°	½	*43337.03+y*		
	g ⁴D	½			
		1½			
		2½			
		3½	44598.80		
4p²(f ³P)3d	h ⁴F	1½	44823.06	86.44	
		2½	44909.50	106.87	
		3½	45016.37	109.20	
		4½	45125.57		
	i ⁴F	1½	47898.95	47.30	
		2½	47946.25	125.52	
		3½	48071.77	251.81?	
		4½	48323.58?		
	u ²D°	1½	*51231.50+y*	98.04	
		2½	*51329.54+y*		
Sc II (a ³D₁)	*Limit*	-----	52920		

Sc I Observed Terms*

Config. 1s² 2s² 2p⁶ 3s² 3p⁶+	Observed Terms		
3d 4s²	a ²D		
3d³	{ e ⁴P e ⁴F ; f ²D:		

	ns (n≥ 4)	np (n≥4)	nd (n≥ 3)
3d 4s(a ³D)nx	{ e ⁴D, e ²D	z ⁴P° z ⁴D° z ⁴F° ; y ²P° y ²D° y ²F°	f ⁴P f ⁴D f ⁴F e ⁴G ; e ²P g ²D e ²F e ²G
3d 4s(a ¹D)nx		z ²P° z ²D° z ²F°	
3d²(a ³F)nx	{ a, g ⁴F ; a ²F	y ⁴D° y ⁴F° z ⁴G° ; x ²D° x ²F° z ²G°	
3d²(b ¹D)nx	b ²D	w ²P° w ²D°	
3d²(a ¹S)nx		x ²P°	
3d²(a ³P)nx	{ a ⁴P ; a ²P	z ⁴S° y ⁴P° x ⁴D° ; z ²S°: v ²D°:	
3d²(a ¹G)nx	a ²G	w ²F° y ²G° z ²H°	
4p²(f ³P)nx			h ⁴F

*For predicted terms in the spectra of the Sc I isoelectronic sequence, see Introduction.

Sc II

(Ca I sequence; 20 electrons)   Z=21

Ground state $1s^2\, 2s^2\, 2p^6\, 3s^2\, 3p^6\, 3d\, 4s\ ^3D_1$

$a\ ^3D_1$ **104000** cm^{-1} I. P. 12.89 volts

The analysis is from Russell and Meggers.   All the terms are from the 1927 paper, except $y\ ^1P°$, which has been taken from the later reference.   By analogy with Y II they assign $a\ ^1S$ to the configuration $4s^2$ in place of the earlier assignment to $3d^2$.

The singlet and triplet terms are connected by observed intersystem combinations.

The g-values have been generously furnished by Catalán, who has calculated them from the observed Zeeman patterns given in the 1925 reference below.

REFERENCES

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H. N. Russell and W. F. Meggers, Sci. Papers Bur. Std. **22**, No. 558, 331 (1927).   (I P) (T) (C L) (G D)
W. F. Meggers and H. N. Russell, Bur. Std. J. Research **2**, 761, RP 55 (1929).   (T) (C L)
M. A. Catalán, unpublished material (June 1948).   (Z E)

Sc II | Sc II

Config.	Desig.	J	Level	Interval	Obs. g.	Config.	Desig.	J	Level	Interval	Obs. g
$3d(^2D)4s$	$a\ ^3D$	1	0.00	67.68	0.50	$3d(^2D)5s$	$e\ ^3D$	1	57551.46	62.48	
		2	67.68	109.95	1.17			2	57613.94	129.43	
		3	177.63		1.33			3	57743.37		
$3d(^2D)4s$	$a\ ^1D$	2	2540.97		1.00	$3d(^2D)5s$	$e\ ^1D$	2	58251.92		
$3d^2$	$a\ ^3F_i$	2	4802.75	80.67	0.67	$3d(^2D)4d$	$e\ ^1F$	3	59528.22		
		3	4883.42	104.22	1.07	$3d(^2D)4d$	$f\ ^3D$	1	59874.79	54.39	
		4	4987.64		1.24			2	59929.18	72.42	
$3d^2$	$b\ ^1D$	2	10944.51					3	60001.60		
$4s^2$	$a\ ^1S$	0	11736.35			$3d(^2D)4d$	$e\ ^3G$	3	60266.95	81.25	
$3d^2$	$a\ ^3P$	0	12074.00	27.45				4	60348.20	108.77	
		1	12101.45	52.89				5	60456.97		
		2	12154.34			$3d(^2D)4d$	$e\ ^1P$	1	60400.02		
$3d^2$	$a\ ^1G$	4	14261.40			$3d(^2D)4d$	$e\ ^3S$	1	61071.10		
$3d(^2D)4p$	$z\ ^1D°$	2	26081.32		1.00	$3d(^2D)4d$	$e\ ^3F$	2	63373.91	70.52	
$3d(^2D)4p$	$z\ ^3F°$	2	27443.65	158.67	0.65			3	63444.43	83.30	
		3	27602.32	238.85	1.10			4	63527.73		
		4	27841.17		1.25	$3d(^2D)4d$	$f\ ^1D$	2	64366.15		
$3d(^2D)4p$	$z\ ^3D°$	1	27917.69	103.52	0.51	$3d(^2D)4d$	$e\ ^3P$	0	64615.28	30.80	
		2	28021.21	139.82	1.16			1	64646.08	59.08	
		3	28161.03		1.33			2	64705.16		
$3d(^2D)4p$	$z\ ^3P°$	0	29736.22	5.90		$3d(^2D)4d$	$e\ ^1S$	0	64942.79		
		1	29742.12	81.80		$3d(^2D)4d$	$e\ ^1G$	4	65235.83		
		2	29823.92		1.50						
$3d(^2D)4p$	$z\ ^1P°$	1	30815.65		1.00	$4p^2$	$f\ ^3P$	0	76242.40	117.41	
$3d(^2D)4p$	$z\ ^1F°$	3	32349.98		1.00			1	76359.81	228.67	
$4s(^2S)4p$	$y\ ^3P°$	0	39001.59	112.85				2	76588.48		
		1	39114.44	230.46							
		2	39344.90			Sc III ($^2D_{1\frac{1}{2}}$)	*Limit*	-----	104000		
$4s(^2S)4p$	$y\ ^1P°$	1	55715 52								

June 1948.

Sc II Observed Terms*

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Observed Terms								
$3d^2$	{	$a\,^3P$	$b\,^1D$	$a\,^3F$	$a\,^1G$				
$4s^2$	$a\,^1S$								
$4p^2$	$f\,^3P$								

	$ns\ (n\ge 4)$	$np\ (n\ge 4)$			$nd\ (n\ge 4)$				
$3d(^2D)nx$	{ $a,\,e\,^3D$ $a,\,e\,^1D$	$z\,^3P^\circ$ $z\,^3D^\circ$ $z\,^3F^\circ$ $z\,^1P^\circ$ $z\,^1D^\circ$ $z\,^1F^\circ$			$e\,^3S$ $e\,^3P$ $f\,^3D$ $e\,^3F$ $e\,^3G$ $e\,^1S$ $e\,^1P$ $f\,^1D$ $e\,^1F$ $e\,^1G$				
$4s(^2S)nx$	{	$y\,^3P^\circ$ $y\,^1P^\circ$							

*A chart of predicted terms in the spectra of the Ca I isoelectronic sequence is given in the Introduction. Owing to the change in binding energies of the $3d$ and $4s$ electrons along this sequence, the arrangement of the charts of observed and predicted terms is not identical. In Sc II no primes are used to indicate higher limits, and the prefixes a, b, . . . e, z, y, replace those indicating the running electron.

Sc III

(K I sequence; 19 electrons) $Z=21$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d\ ^2D_{1\frac{1}{2}}$

$3d\ ^2D_{1\frac{1}{2}}$ **199693.0 cm^{-1}**   I. P. 24.75 volts

       The early analysis by Gibbs and White was revised and extended by Smith. By analogy with Ti IV, Russell and Lang confirmed Smith's interpretation, added the $5s\ ^2S$ term, and predicted a number of series members. Their term array has been used for the present compilation, predicted values being entered in brackets. Fourteen lines in the range from 730 A to 4069 A have been classified.

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H. N. Russell and R. J. Lang, Astroph. J. **66**, 19; Mt. Wilson Contr. No. 337 (1927). (I P) (T) (C L)

Sc III   Sc III

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3p^6(^1S)3d$	$3d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	0. 0 197. 5	197. 5	$3p^6(^1S)5d$	$5d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	[148263] [148283]	20
$3p^6(^1S)4s$	$4s\ ^2S$	$\frac{1}{2}$	25536. 7		$3p^6(^1S)6s$	$6s\ ^2S$	$\frac{1}{2}$	[149253]	
$3p^6(^1S)4p$	$4p\ ^2P^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$	*62102. 2* *62575. 9*	473. 7	$3p^6(^1S)5f$	$5f\ ^2F^\circ$	{ $2\frac{1}{2}$ $3\frac{1}{2}$ }	*[159553]*	
$3p^6(^1S)4d$	$4d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	112254. 2 112299. 2	45. 0	$3p^6(^1S)5g$	$5g\ ^2G$	{ $3\frac{1}{2}$ $4\frac{1}{2}$ }	[160133]	
$3p^6(^1S)5s$	$5s\ ^2S$	$\frac{1}{2}$	114863. 8						
$3p^6(^1S)5p$	$5p\ ^2P^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$	*[128183]* *[128363]*	180	Sc IV ($^1S_0$)	*Limit*		199693. 0	
$3p^6(^1S)4f$	$4f\ ^2F^\circ$	{ $2\frac{1}{2}$ $3\frac{1}{2}$ }	*136871. 0*						

May 1948.

Sc IV

(A I sequence; 18 electrons) $\qquad$ $Z=21$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\ {}^1S_0$

$3p^6\ {}^1S_0$ **596300** cm^{-1} $\qquad\qquad$ I. P. 73.9 volts

The analysis is seriously incomplete, but four lines between 215 A and 298 A have been independently classified, in the first two references quoted below, as combinations with the ground term. The two sets of wavelengths are not completely accordant, but the interpretation is the same in both papers.

The levels given in the table are from Mrs. Beckman's observations, and the limit is from the other paper. Mrs. Beckman's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}, and all values have been rounded off in the last places. The limit may be in error by several hundred cm^{-1}.

For convenience, the Paschen notation has been added by the writer in column one of the table, under the heading "A I". As for A I, the jl-coupling notation in the general form suggested by Racah is here introduced, although LS-designations as indicated in column two under the heading "Authors" are perhaps preferable for the terms thus far identified.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 90 (Almqvist and Wiksells Boktryckeri –A.–B., Uppsala, 1937). (T) (C L)
P. G. Kruger, S. G. Weissberg and L. W. Phillips, Phys. Rev. **51**, 1090 (1937). (I P) (T) (C L)
G. Racah, Phys. Rev. **61**, 537 (L) (1942).

Sc IV

A I	Authors		Config.	Desig.	J	Level
$1p_0$	$3p^6$	^{1}S	$3p^6$	$3p^6\ ^1$S	0	0
$1s_4$	$3p^5\,4s$	^{3}P°	$3p^5(^2P^o_{1\frac12})4s$	$4s\ [1\frac12]°$	2	
					1	335090
$1s_2$	$3p^5\,4s$	^{1}P°	$3p^5(^2P^o_{\frac12})4s$	$4s'\ [\ \frac12]°$	0	
					1	341010
$2s_4$	$3p^5\,5s$	^{3}P°	$3p^5[^2P^o_{1\frac12})5s$	$5s\ [1\frac12]°$	2	
					1	460430
$2s_2$	$3p^5\,5s$	^{1}P°	$3p^5(^2P^o_{\frac12})5s$	$5s'\ [\ \frac12]°$	0	
					1	463990
			Sc v $(^2P^o_{1\frac12})$	*Limit*	-----	596300
			Sc v $(^2P^o_{\frac12})$	*Limit*	-----	600630

May 1948.

Sc V

(Cl I sequence; 17 electrons) $Z=21$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^5\ {}^2\mathrm{P}^\circ_{1\frac{1}{2}}$

$3p^5\ {}^2\mathrm{P}^\circ_{1\frac{1}{2}}\ \textit{741000}$ cm^{-1} I. P. 92 volts

Fifteen lines have been classified in the region from 228 A to 587 A, as combinations from the ground term. Two independent sets of term values have been published, that are in agreement except for the level $4s\ {}^4\mathrm{P}_{2\frac{1}{2}}$, for which Kruger and Phillips give 387508 cm^{-1}; and the level $4s\ {}^4\mathrm{P}_{\frac{1}{2}}$, which was not found by Mrs. Beckman. All other entries in the table are from the latter list. The unit adopted by Mrs. Beckman, 10^3 cm^{-1}, has here been changed to cm^{-1}.

From isoelectronic sequence data Edlén has estimated the limit given above and entered in brackets in the table.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling
    p. 86 (Almqvist and Wiksells Boktryckeri –A.–B., Uppsala, 1937). (T) (C L)
P. G. Kruger and L. W. Phillips, Phys. Rev. **51**, 1087 (1937). (T) (C L)
B. Edlén, Zeit. Phys. **104**, 413 (1937). (I P)

Sc V

Config.	Desig.	J	Level	Interval
$3s^2\,3p^5$	$3p^5\ {}^2\mathrm{P}^\circ$	$1\frac{1}{2}$ $\frac{1}{2}$	*0* *4328*	-4328
$3s\ \ 3p^6$	$3p^6\ {}^2\mathrm{S}$	$\frac{1}{2}$	174412	
$3s^2\,3p^4({}^3\mathrm{P})4s$	$4s\ \ {}^4\mathrm{P}$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	386387 388868 391575?	-2481 -2707
$3s^2\,3p^4({}^3\mathrm{P})4s$	$4s\ \ {}^2\mathrm{P}$	$1\frac{1}{2}$ $\frac{1}{2}$	395503 398447	-2944
$3s^2\,3p^4({}^1\mathrm{D})4s$	$4s'\ {}^2\mathrm{D}$	$2\frac{1}{2}$ $1\frac{1}{2}$	410050 410133	-83
$3s^2\,3p^4({}^1\mathrm{S})4s$	$4s''\ {}^2\mathrm{S}$	$\frac{1}{2}$	437512	
Sc VI $({}^3\mathrm{P}_2)$	*Limit*	-------	[*741000*]	

January 1948.

Sc VI

(S I sequence; 16 electrons) $Z=21$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4\ {}^3P_2$

$3p^4\ {}^3P_2\ 896000\ cm^{-1}$ I. P. 111.1 volts

The analysis has been done independently by Mrs. Beckman and by Kruger and Pattin with results that are substantially in agreement. The triplet terms are quoted from the former and the singlets from the latter paper. Twenty-nine lines have been classified in the interval between 200 A and 581 A. The unit adopted by Mrs. Beckman, $10^3\ cm^{-1}$, has here been changed to cm^{-1}.

Intersystem combinations connecting the singlet and triplet terms have been observed. The limit is from Edlén, who has extrapolated it from isoelectronic sequence data.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 76 (Almqvist and Wiksells Boktryckeri –A.–B., Uppsala 1937). (T) (C L)

P. G. Kruger and H. S. Pattin, Phys. Rev. **52,** 621 (1937). (T) (C L)

B. Edlén, Zeit. Phys. **104,** 192 (1937). (I P)

Sc VI

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\ 3p^4$	$3p^4\ {}^3P$	2 1 0	0 3352 4453	-3352 -1101	$3s^2\ 3p^3({}^2D^\circ)4s$	$4s'\ {}^1D^\circ$	2	478354	
$3s^2\ 3p^4$	$3p^4\ {}^1D$	2	21397		$3s^2\ 3p^3({}^2P^\circ)4s$	$4s''\ {}^3P^\circ$	0 1 2	491826 492087 492802	261 715
$3s^2\ 3p^4$	$3p^4\ {}^1S$	0	49238		$3s^2\ 3p^3({}^2P^\circ)4s$	$4s''\ {}^1P^\circ$	1	497984	
$3s\ 3p^5$	$3p^5\ {}^3P^\circ$	2 1 0	175344 178197 179784	-2853 -1587	Sc VII $({}^4S_{1\frac12}^\circ)$	*Limit*		896000	
$3s^2\ 3p^3({}^4S^\circ)4s$	$4s\ {}^3S^\circ$	1	452070						
$3s^2\ 3p^3({}^2D^\circ)4s$	$4s'\ {}^3D^\circ$	1 2 3	472400 472563 473001	163 438					

January 1948.

Sc VII

(P I sequence; 15 electrons) $Z=21$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^3\ {}^4S^{\circ}_{1\frac{1}{2}}$

$3p^3\ {}^4S^{\circ}_{1\frac{1}{2}}$ cm^{-1} I. P.   volts

The analysis is incomplete. Six multiplets have been published by Kruger and Pattin, who derive term intervals but give no term values. Mrs. Beckman has extended their analysis slightly and estimated the relative positions of the doublet and quartet systems of terms from isoelectronic sequence data. Her terms are, in general, quoted, except for the term $3p^4\ {}^4P$, which is based on the wavelengths by Kruger and Pattin.

Twenty lines have been classified in the interval between 182 A and 571 A. No intersystem combinations have been observed, as indicated by the uncertainty x in the table and brackets around $3p^3\ {}^2D^{\circ}_{1\frac{1}{2}}$.

The unit adopted by Mrs. Beckman, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

P. G. Kruger and H. S. Pattin, Phys. Rev. **52**, 624 (1937). (C L)

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 71 (Almqvist and Wiksells Boktryckeri –A.–B., Uppsala, 1937). (T) (C L)

Sc VII   Sc VII

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^3$	$3p^3\ {}^4S^{\circ}$	$1\frac{1}{2}$	0		$3s^2\,3p^2({}^3P)3d$	$3d\ {}^2P$	$1\frac{1}{2}$	$329950 +x$	-3410
$3s^2\,3p^3$	$3p^3\ {}^2D^{\circ}$	$1\frac{1}{2}$	$[30000]+x$	670			$\frac{1}{2}$	$333360 +x$	
		$2\frac{1}{2}$	$30670 +x$		$3s^2\,3p^2({}^3P)4s$	$4s\ {}^4P$	$\frac{1}{2}$	541670	1930
$3s^2\,3p^3$	$3p^3\ {}^2P^{\circ}$	$\frac{1}{2}$	$49840 +x$	900			$1\frac{1}{2}$	$543600?$	2890
		$1\frac{1}{2}$	$50740 +x$				$2\frac{1}{2}$	546490	
$3s\,3p^4$	$3p^4\ {}^4P$	$2\frac{1}{2}$	175050	-2710	$3s^2\,3p^2({}^3P)4s$	$4s\ {}^2P$	$\frac{1}{2}$	$551940 +x$	3260
		$1\frac{1}{2}$	177760	-1440			$1\frac{1}{2}$	$555200 +x$	
		$\frac{1}{2}$	179200		$3s^2\,3p^2({}^1D)4s$	$4s'\ {}^2D$	$2\frac{1}{2}$	$568860 +x$	-130
							$1\frac{1}{2}$	$568990 +x$	

December 1947.

Sc VII Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2\,3p^3$	$3p^3\ {}^4S^{\circ}$ $3p^3\ {}^2P^{\circ}$ $3p^3\ {}^2D^{\circ}$		
$3s\,3p^4$	$3p^4\ {}^4P$		
	$ns\ (n\geq 4)$		$nd\ (n\geq 3)$
$3s^2\,3p^2({}^3P)nx$	$4s\ {}^4P$ $4s\ {}^2P$		$3d\ {}^2P$
$3s^2\,3p^2({}^1D)nx'$		$4s'\ {}^2D$	

*For predicted terms in the spectra of the P I isoelectronic sequence, see Introduction.

Sc VIII

(Si I sequence; 14 electrons) $\qquad$ $Z=21$

Ground state $1s^2\, 2s^2\, 2p^6\, 3s^2\, 3p^2\, {}^3P_0$

$3p^2\ {}^3P_0$ 1280000 cm^{-1} $\qquad$ I. P. 159 volts

The analysis is incomplete. The results by Kruger and Phillips are not entirely in agreement with those by Mrs. Beckman. The present list has been compiled from the three references below. One term, $4s\,{}^1P_1^\circ$, has been calculated from its combination with $3p^2\,{}^1D_2$ as given by Mrs. Beckman. Twenty-five lines are classified in the region between 164 A and 494 A. Intersystem combinations connecting the singlet and triplet terms have been observed. The limit, entered in brackets in the table, has been estimated by Phillips.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 65 (Almqvist and Wiksells Boktryckeri -A.-B., Uppsala, 1937). (T) (C L)

P. G. Kruger and L. W. Phillips, Phys. Rev. **52**, 97 (1937). (T) (C L)

L. W. Phillips, Phys. Rev. **55**, 708 (1939). (I P) (T) (C L)

Sc VIII

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\,3p^2$	$3p^2\,{}^3P$	0	0	2280	$3s^2\,3p(^2P^\circ)3d$	$3d\ \,{}^3P^\circ$	2	*319570*	−2970
		1	2280	3230			1	*322540*	−1130
		2	5510				0	*323670*	
$3s^2\,3p^2$	$3p^2\,{}^1D$	2	25030		$3s^2\,3p(^2P^\circ)4s$	$4s\ \,{}^3P^\circ$	0	*603540*	1070
							1	*604610*	4570
$3s\ \,3p^3$	$3p^3\,{}^3P^\circ$	2 / 1 / 0	*207760*				2	*609180*	
					$3s^2\,3p(^2P^\circ)4s$	$4s\ \,{}^1P^\circ$	1	*614100*	
$3s\ \,3p^3$	$3p^3\,{}^3S^\circ$	1	*271680*						
$3s\ \,3p^3$	$3p^3\,{}^1P^\circ$	1	*281520*		Sc IX $(^2P^\circ_{1/2})$	*Limit*	-------	[*1280000*]	

October 1947.

Sc IX

(Al I sequence; 13 electrons) $\qquad$ $Z=21$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\ ^2P^\circ_{1/2}$

$3p\ ^2P^\circ_{1/2}\ \textit{1456000}$ cm^{-1} $\qquad$ I. P. 180 volts

The analysis is incomplete, but 17 lines have been classified in the region between 119 A and 537 A. The listed term values have been calculated by the writer from the combinations given in the references below.

No intersystem combinations have been observed. Using the method of extrapolation suggested by Edlén, the writer has estimated that $3p^2\ ^4P_{1/2}$ is about 141000 cm^{-1} above the ground state. This value is entered in brackets in the table and has been added to all quartet terms. The uncertainty x may well exceed ±1000 cm^{-1}. Similarly, she has extrapolated the value of the limit quoted above and entered in brackets in the table. The uncertainty in this estimate is large owing to the incompleteness of the isoelectronic sequence data.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 59 (Almqvist and Wiksells Boktryckeri -A.-B., Uppsala 1937). (T) (C L)
P. G. Kruger and L. W. Phillips, Phys. Rev. **52**, 97 (1937). (T) (C L)

Sc IX

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2(^1S)3p$	$3p\ ^2P^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$	*0* *5760*	5760	$3s^2(^1S)4s$	$4s\ ^2S$	$\frac{1}{2}$	666260	
$3s\,3p^2$	$3p^2\ ^4P$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	[141000]$+x$ *143120* $+x$ *146280* $+x$	2120 3160	$3s\,3p(^3P^\circ)4s$	$4s\ ^4P^\circ$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	*819550* $+x$ *821490* $+x$ *825120* $+x$	1940 3630
$3s\,3p^2$	$3p^2\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	 191760		$3s^2(^1S)4d$	$4d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	837210 837450	240
$3s\,3p^2$	$3p^2\ ^2S$	$\frac{1}{2}$	240410		Sc x ($^1S_0$)	*Limit*		[*1456000*]	
$3s\,3p^2$	$3p^2\ ^2P$	$\frac{1}{2}$ $1\frac{1}{2}$	255830 259150	3320					
$3s^2(^1S)3d$	$3d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	313860 314210	350					

October 1947.

Sc IX Observed Terms*

Config. $1s^2\,2s^2\,2p^6+$	Observed Terms		
$3s^2(^1S)3p$		$3p\ ^2P^\circ$	
$3s\,3p^2$	$\{3p^2\ ^2S$	$3p^2\ ^4P$ $3p^2\ ^2P$	$3p^2\ ^2D$
		$ns\ (n\geq4)$	$nd\ (n\geq3)$
$3s^2(^1S)nx$	$4s\ ^2S$		$3,\,4d\,^2D$
$3s\,3p(^3P^\circ)nx$		$4s\ ^4P^\circ$	

*For predicted terms in the spectra of the Al I isoelectronic sequence, see Introduction.

Sc X

(Mg I sequence; 12 electrons) $Z=21$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ {}^1S_0$

$3s^2\ {}^1S_0$ 1819530 cm^{-1} I. P. 225.5 volts

The terms are from the paper by Mrs. Beckman, who has classified 26 lines in the region between 76 A and 628 A. She lists one intersystem combination, $3s^2\ {}^1S_0-3p\ {}^3P_1^\circ$, and derives absolute term values from the $3d\ {}^3D-nf\ {}^3F^\circ$ series ($n=4, 5, 6$).

Parker and Phillips have independently found four triplet terms $3p\ {}^3P^\circ$, $3d\ {}^3D$, $4s\ {}^3S$, and $4f\ {}^3F^\circ$. Their arrangement of the $3p\ {}^3P^\circ-4s\ {}^3S$ and $3d\ {}^3D-4f\ {}^3F^\circ$ multiplets is identical with Mrs. Beckman's but they differ from her in the interpretation of the group of lines ascribed to $3p\ {}^3P^\circ-3d\ {}^3D$.

Their resulting terms that differ from those listed below (adjusted to the same zero point) are as follows:

Desig.	Level	Desig.	Level
$3d\ {}^3D_3$	455510	$4f\ {}^3F_4^\circ$	1117757
${}^3D_2$	455199	${}^3F_3^\circ$	1117710
${}^3D_1$	455007	${}^3F_2^\circ$	1117689

By extrapolation along the isoelectronic sequence, using the method suggested by Edlén, the writer calculates the limit to be approximately 1818600 cm^{-1} (I. P. 225.4), or about 1000 cm^{-1} lower than that derived by Mrs. Beckman from the ${}^3F^\circ$ series.

The unit adopted by Mrs. Beckman, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling p. 53 (Almqvist and Wiksells Boktryckeri -A.-B., Uppsala, 1937). (I P) (T) (C L) (G D)

W. L. Parker and L. W. Phillips, Phys. Rev. **57**, 140 (1940). (T) (C L)

Sc X   Sc X

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\ {}^1S$	0	0		$3s({}^2S)5p$	$5p\ {}^1P^\circ$	1	*1309880*	
$3s({}^2S)3p$	$3p\ {}^3P^\circ$	0	*157230*	1980	$3s({}^2S)5d$	$5d\ {}^3D$	1		
		1	*159210*				2		
		2	*163530*	4320			3	1351120	
$3s({}^2S)3p$	$3p\ {}^1P^\circ$	1	*236490*		$3s({}^2S)5f$	$5f\ {}^3F^\circ$	2	*1374440*	110
$3s({}^2S)3d$	$3d\ {}^3D$	1	458710	320			3	*1374550*	
		2	459030				4		
		3	459470	440	$3s({}^2S)6f$	$6f\ {}^3F^\circ$	2		
$3s({}^2S)4s$	$4s\ {}^3S$	1	899250				3		
							4	*1511130*	
$3s({}^2S)4p$	$4p\ {}^1P^\circ$	1	*980600*						
$3s({}^2S)4d$	$4d\ {}^3D$	1	1074060	190	Sc XI $({}^2S_{1/2})$	Limit	-------	*1819530*	
		2	1074250						
		3	1074530	280					
$3s({}^2S)4f$	$4f\ {}^3F^\circ$	2	*1121400*	150					
		3	*1121550*						
		4	*1121740*	190					

Sc XI

(Na I sequence; 11 electrons) $Z=21$

Ground state $1s^2\, 2s^2\, 2p^6\, 3s\ ^2S_{1/2}$

$3s\ ^2S_{1/2}$ **2015030 cm^{-1}**   I. P. 249.76 volts

   The analysis is by Mrs. Beckman who has extended the work of Edlén and of Kruger and Phillips.   She has published 30 classified lines in the interval from 62 A to 168 A.
   The absolute value of the ground state is extrapolated from isoelectronic sequence data.
   The unit adopted by Mrs. Beckman, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

B. Edlén, Zeit. Phys. **100**, 621 (1936).   (T) (C L)
A. Beckman, *Bidrag till Kännedomen om Skandiums Spektrum i Yttersta Ultraviolett*, Akademisk Avhandling, p. 45 (Almqvist and Wiksells Boktryckéri -A.-B., Uppsala, 1937).   (I P) (T) (C L) (G D)

<table>
<tr><td colspan="5" align="center">Sc XI</td><td colspan="5" align="center">Sc XI</td></tr>
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Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
3s	3s ^{2}S	½	0		5f	5f ^{2}F°	2½ 3½	*1482160* *1482210*	50
3p	3p ^{2}P°	½ 1½	*191030* *197720*	6690	6s	6s ^{2}S	½	1588790	
3d	3d ^{2}D	1½ 2½	459410 460030	620	6p	6p ^{2}P°	½ 1½	*1609480*	
4s	4s ^{2}S	½	977470		6d	6d ^{2}D	1½ 2½	1635020	
4p	4p ^{2}P°	½ 1½	*1051340* *1053870*	2530	6f	6f ^{2}F°	2½ 3½	*1645030*	
4d	4d ^{2}D	1½ 2½	1148560 1148830	270	7d	7d ^{2}D	1½ 2½	1736700	
4f	4f ^{2}F°	2½ 3½	*1182570* *1182680*	110	7f	7f ^{2}F°	2½ 3½	*1743430*	
5s	5s ^{2}S	½	1382110						
5p	5p ^{2}P°	½ 1½	*1418280* *1419550*	1270	Sc XII (^{1}S$_0$)	*Limit*	-------	2015030	
5d	5d ^{2}D	1½ 2½	1464770 1464870	100					

June 1947.

Sc XII

(Ne I sequence; 10 electrons) $Z=21$

Ground state $1s^2\ 2s^2\ 2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ 5539700 cm^{-1} I. P. 686.6 volts

Edlén and Tyrén have classified five lines in the range 26 A to 30 A, as combinations with the ground term. Their absolute term values are based on extrapolation along the Ne I isoelectronic sequence. Their unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

As for Ne I, the jl-coupling notation in the general form suggested by Racah is introduced.

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Sc XII

Authors	Config.	Desig.	J	Level
$2p\ {}^1S_0$	$2p^6$	$2p^6\ {}^1S$	0	0
$3s\ {}^3P_1$	$2p^5({}^2P^o_{1\frac{1}{2}})3s$	$3s\ [1\frac{1}{2}]^o$	2 1	 3245100
$3s\ {}^1P_1$	$2p^5({}^2P^o_{\frac{1}{2}})3s$	$3s'\ [\ \frac{1}{2}]^o$	0 1	 3280800
$3d\ {}^3P_1$	$2p^5({}^2P^o_{1\frac{1}{2}})3d$	$3d\ [\ \frac{1}{2}]^o$	0 1	 3668400
$3d\ {}^1P_1$	"	$3d\ [1\frac{1}{2}]^o$	1	3714700
$3d\ {}^3D_1$	$2p^5({}^2P^o_{\frac{1}{2}})3d$	$3d'\ [1\frac{1}{2}]^o$	1	3767300
------------	------	---	-------
Sc XIII $({}^2P^o_{1\frac{1}{2}})$	*Limit*	---	5539700
Sc XIII $({}^2P^o_{\frac{1}{2}})$	*Limit*	---	5577400

April 1947.

TITANIUM

Ti I

22 electrons $Z=22$

Ground state $1s^2\, 2s^2\, 2p^6\, 3s^2\, 3p^6\, 3d^2\, 4s^2\; {}^3F_2$

$a\; {}^3F_2$ 55138 cm^{-1} I. P. 6.83 volts

The arc spectrum of titanium was one of the first highly complex spectra to be analyzed fairly completely. The detailed analysis published by Russell in 1927 contains 142 terms based on 422 multiplets, and lists 1394 classified lines. Singlet, triplet, and quintet terms are connected by intersystem combinations. This paper, which represents the work of many early contributions as well, by King, Meggers, Kiess, Babcock, and many others, is concluded with the noteworthy statement "The present theories of atomic and spectral structure suffice to give a most satisfactory account, in full and complete detail, of all the features of the very complex spectrum of titanium."

From infrared observations Kiess and Meggers have added the terms $d\,{}^3P$ and $a\,{}^5D$. In 1940 Russell added $e\,{}^3H$ and in 1947 he revised the configuration assignments for inclusion here, as given in column one of the table.

The term values given to three places in the table are from the 1928 paper by Kiess, who calculated them from lines he observed with the interferometer.

Approximate g-values have been calculated by the writer from the Zeeman patterns observed by King and Babcock and quoted by Russell (1927). Most of the observed patterns are unresolved, and consequently the observed g-values differ from the theoretical ones, by a few percent in some cases. They verify the analysis, however, with remarkable consistency. Colons indicate that the observational data are insufficient to give an independent g-value. It is highly desirable to extend this work with the aid of Harrison's unpublished Zeeman observations of titanium.

Both Many and Rohrlich have made theoretical investigations of this spectrum. In the former paper the reality of the term $a\,{}^1S_0$ at 15166.59 is questioned and this term has been rejected by Russell. Rohrlich has suggested that the ${}^1P^\circ$ term at 39265.80 may be a ${}^1D^\circ$ term. This change has been adopted in the table and the labels of higher ${}^1P^\circ$ and ${}^1D^\circ$ terms changed accordingly, since it has been noted by Russell that this term may equally well be a ${}^1D^\circ$ term. In cases where Rohrlich's configuration assignments differ from those of Russell a colon is entered in column one after the configuration.

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Ti I

Config.	Desig.	J	Level	Interval	Obs. g
3d² 4s²	a ³F	2	0.000	170.132	0.66
		3	170.132	216.741	1.08
		4	386.873		1.25
3d³(b ⁴F)4s	a ⁵F	1	6556.86		0.00
		2	6598.83	41.97	0.99
		3	6661.00	62.17	1.25
		4	6742.79	81.79	1.35
		5	6843.00	100.21	1.41
3d² 4s²	a ¹D	2	7255.29		1.02
3d² 4s²	a ³P	0	8436.630		
		1	8492.437	55.807	1.50
		2	8602.353	109.916	1.49
3d³(b ⁴F)4s	b ³F	2	11531.812	108.008	0.67
		3	11639.820	137.000	1.08
		4	11776.820		1.26
3d² 4s²	a¹ G	4	12118.46		0.98
3d³(a ⁴P)4s	a ⁵P	1	13981.75	46.72	2.50
		2	14028.47	77.21	1.82
		3	14105.68		1.66
3d³(a ²G)4s	a ³G	3	15108.153	48.650	0.74
		4	15156.803	63.597	1.06
		5	15220.400		1.21
3d² 4s(a ⁴F)4p	z ⁵G°	2	15877.18	98.41	0.39
		3	15975.59	130.49	0.93
		4	16106.08	161.43	1.15
		5	16267.51	191.20	1.25
		6	16458.71		1.33
3d² 4s(a ⁴F)4p	z ⁵F°	1	16817.19	58.00	0.00
		2	16875.19	86.23	
		3	16961.42	113.89	1.26:
		4	17075.31	140.13	1.34
		5	17215.44		1.42
3d³(b ²D)4s	a ³D	1	17369.59	54.52	0.49
		2	17424.11	116.22	1.17
		3	17540.33		1.34
3d³(a ²P)4s	b ³P	0	17995.75	65.79	
		1	18061.54	83.86	
		2	18145.40		
3d³(a ²H)4s	a ³H	4	18037.28	103.97	0.80
		5	18141.252	51.342	1.02
		6	18192.594		1.17
3d³(a ²G)4s	b ¹G	4	18287.62		1.02
3d² 4s(a ⁴F)4p	z ⁵D°	0	18462.83	20.03	
		1	18482.86	42.21	1.65?
		2	18525.07	68.92	1.50
		3	18593.99	101.24	1.49
		4	18695.23		1.51
3d³(a ⁴P)4s	c ³P	0	18818.23	7.66	1.54?
		1	18825.89	85.66	1.54:
		2	18911.55		

Ti I

Config.	Desig.	J	Level	Interval	Obs. g
3d² 4s(a ²F)4p	z ³F°	2	19323.003	98.577	0.67
		3	19421.580	152.400	1.07
		4	19573.980		1.26
3d² 4s(a ²F)4p	z ³D°	1	19937.878	68.171	
		2	20006.049	120.023	1.16
		3	20126.072		1.34
3d³(a ²P)4s	a ¹P	1	20062.98		1.03
3d³(b ²D)4s	b ¹D	2	20209.64		1.01:
3d³(a ²H)4s	a ¹H	5	20795.65		1.01
3d² 4s(a ²F)4p:	z ³G°	3	21469.534	118.986	0.75
		4	21588.520	151.223	1.05
		5	21739.743		1.21
3d² 4s(a ²F)4p	z ¹D°	2	22081.15		1.00
3d² 4s(a ²F)4p	z ¹F°	3	22404.69		1.00
3d² 4s(a ²F)4p	z ¹G°	4	24694.81		0.97
3d² 4s(b ⁴P)4p	z ³S°	1	24921.19		1.99
3d² 4s(b ⁴P)4p	z ⁵S°	2	25102.88		1.93
3d² 4s(a ⁴F)4p:	y ³F°	2	25107.453	119.783	1.06
		3	25227.236	161.109	
		4	25388.345		1.21?
3d² 4s(a ⁴F)4p:	y ³D°	1	25317.842	121.088	0.50
		2	25438.930	204.794	1.17
		3	25643.724		1.33
3d² 4s(b ⁴P)4p	z ³P°	2	25493.78	−43.61	1.47
		1	25537.39		1.50
		0			
3d² 4s(b ⁴P)4p:	y ⁵D°	0	25605.03	30.71	
		1	25635.74	64.21	
		2	25699.95	97.65	
		3	25797.60	129.22	
		4	25926.82		1.52
3d³(b ⁴F)4p	y ⁵G°	2	26494.37	70.06	0.34
		3	26564.43	92.98	0.91
		4	26657.41	115.57	1.15
		5	26772.98	137.71	1.25
		6	26910.69		1.34
3d³(b ⁴F)4p:	x ³F°	2	26803.462	89.484	0.66
		3	26892.946	132.721	1.06
		4	27025.667		1.23
3d³(b ⁴F)4p	x ³D°	1	27355.065	62.972	0.51
		2	27418.037	62.040	1.17
		3	27480.077		1.36
3d³(b ⁴F)4p:	y ³G°	3	27499.033	115.660	0.75
		4	27614.693	135.463	1.05
		5	27750.156		1.21
3d² 4s(b ⁴P)4p	z ⁵P°	1	27665.57	74.62	
		2	27740.19	147.55	
		3	27887.74		

Ti I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3d^2\,4s(a\ ^2D)4p$:	$y\ ^1D^\circ$	2	27906.91		0.98
$3d^3(b\ ^4F)4p$	$y\ ^5F^\circ$	1	28596.45		0.00
		2	28638.82	42.37	1.01
		3	28702.70	63.88	1.24
		4	28788.39	85.69	1.34
		5	28896.08	107.69	1.40
$3d^4$	$a\ ^5D$	0	28772.86		
		1	28791.62	18.76	
		2	28828.51	36.89	
		3	28882.44	53.93	
		4	28952.10	69.66	
$3d^2\,4s(b\ ^4P)4p$:	$w\ ^3D^\circ$	1	29661.272		0.51
		2	29768.686	107.414	1.16
		3	29912.292	143.606	1.34
$3d^3(b\ ^2F)4s$	$a\ ^1F$	3	29818.31		
$3d^3(b\ ^4F)4p$	$x\ ^5D^\circ$	0	29829.16		
		1	29855.26	26.10	1.46
		2	29907.29	52.03	1.50
		3	29986.24	78.95	1.49
		4	30060.34	74.10	1.49
$3d^2\,4s(a\ ^4F)4p$:	$x\ ^3G^\circ$	3	29914.773		
		4	29971.106	56.333	
		5	30039.246	68.140	1.19
$3d^2\,4s(a\ ^2D)4p$:	$v\ ^3D^\circ$	1	31184.089		0.51
		2	31190.663	6.574	1.17
		3	31206.014	15.351	1.34
$3d^2\,4s(b\ ^2G)4p$:	$w\ ^3G^\circ$	3	31373.862		0.75
		4	31489.486	115.624	1.05
		5	31628.698	139.212	1.19
$3d^2\,4s(a\ ^2D)4p$:	$y\ ^3P^\circ$	0	31685.90		
		1	31725.75	39.85	1.47
		2	31805.94	80.19	
$3d^2\,4s(b\ ^2G)4p$	$z\ ^3H^\circ$	4	31830.016		0.80
		5	31914.304	84.288	1.04
		6	32013.555	99.251	1.17
$3d^2\,4s(a\ ^2D)4p$	$y\ ^1F^\circ$	3	32857.76		0.99?
$3d^2\,4s(b\ ^2P)4p$:	$x\ ^3P^\circ$	0	33085.14		
		1	33090.55	5.41	1.46
		2	33114.49	23.94	1.46
$3d^2\,4s(a\ ^2D)4p$:	$w\ ^3F^\circ$	2	33655.898		0.66
		3	33680.162	24.264	1.09
		4	33700.897	20.735	1.26
$3d^2\,4s(a\ ^2D)4p$:	$z\ ^1P^\circ$	1	33660.73		0.94?
$3d^2\,4s(b\ ^2G)4p$	$v\ ^3F^\circ$	2	33980.685		0.63
		3	34078.612	97.927	1.10
		4	34205.001	126.389	1.23
$3d^4$	$d\ ^3P$	0	34170.95		
		1	34327.96	157.01	
		2	34535.04	207.08	
$3d^2\,4s(b\ ^2G)4p$:	$z\ ^1H^\circ$	5	34700.31		1.02
$3d^2\,4s(b\ ^2P)4p$:	$y\ ^1P^\circ$	1	34947.02		
$3d^2\,4s(b\ ^2P)4p$:	$x\ ^1D^\circ$	2	35035.11		
$3d^2\,4s(b\ ^2P)4p$	$y\ ^3S^\circ$	1	35439.43		2.18
$3d^3(a\ ^2G)4p$	$y\ ^3H^\circ$	4	35454.099		0.79
		5	35559.662	105.563	1.04
		6	35685.188	125.526	1.17
$3d^3(a\ ^4P)4p$	$w\ ^5D^\circ$	0	35503.40		
		1	35527.76	24.36	1.51
		2	35577.14	49.38	1.53
		3	35652.95	75.81	1.46
		4	35757.51	104.56	1.46
$3d^2\,4s(a\ ^4F)5s$	$e\ ^5F$	1	35959.07		0.00
		2	36013.57	54.50	1.03?
		3	36096.47	82.90	1.24
		4	36208.92	112.45	1.34
		5	36351.43	142.51	1.42
$3d^2\,4s(b\ ^2G)4p$:	$y\ ^1G^\circ$	4	36000.25		1.00
$3d^4$	$b\ ^3G$	3	36065.75		
		4	36132.21	66.46	
		5	36200.94	68.73	
$3d^3(a\ ^4P)4p$	$y\ ^5P^\circ$	1	36298.43		2.47
		2	36340.67	42.24	1.81
		3	36414.58	73.91	1.66
$3d^3(b\ ^2D)4p$:	$w\ ^3P^\circ$	0	37090.65		
		1	37173.03	82.38	1.53
		2	37325.47	152.44	1.48
$3d^3(a\ ^4P)4p$	$y\ ^5S^\circ$	2	37359.13		1.99
$3d^2\,4s(a\ ^4F)5s$	$e\ ^3F$	2	37538.71		0.67
		3	37659.97	121.26	1.11
		4	37824.69	164.72	1.27
$3d^3(a\ ^2G)4p$	$v\ ^3G^\circ$	3	37554.99		0.77
		4	37617.93	62.94	1.05
		5	37690.37	72.44	1.20
$3d^2\,4s(b\ ^2G)4p$:	$x\ ^1F^\circ$	3	37622.63		0.94
$3d^3(b\ ^2D)4p$:	$u\ ^3F^\circ$	2	37654.77		0.65
		3	37743.96	89.19	1.08
		4	37852.47	108.51	1.24
$3d^2\,4s(b\ ^2P)4p$:	$u\ ^3D^\circ$	1	37851.91		0.53
		2	37976.78	124.87	1.14:
		3	38159.71	182.93	1.35
$3d^3(a\ ^2P)4p$	$z\ ^1S^\circ$	0	38200.94		
$3d^3(a\ ^2G)4p$	$t\ ^3F^\circ$	2	38451.29		0.66
		3	38544.38	93.09	1.08
		4	38670.73	126.35	1.25
$3d^3(a\ ^2H)4p$	$z\ ^3I^\circ$	5	38572.75		0.81
		6	38669.03	96.28	1.02
		7	38779.97	110.94	1.15
$3d^3(b\ ^2D)4p$:	$t\ ^3D^\circ$	1	38654.23		0.54:
		2	38699.95	45.72	
		3	38764.96	65.01	1.32

Config.	Desig.	J	Level	Interval	Obs. g	Config.	Desig.	J	Level	Interval	Obs. g
3d³(a ²G)4p:	x ¹G°	4	38959.53		1.02		w ³H°	4	41780.95		
3d³(b ²D)4p	x ¹P°	1	39078.00					5	41895.15	114.20	
3d³(b ⁴F)5s	f ⁵F	1	39107.25					6	41995.39	100.24	
		2	39149.26	42.01		3d² 4s(a ⁴F)5p	v ⁵D°	0	41822.99		
		3	39214.38	65.12				1	41854.01	31.02	
		4	39302.36	87.98				2	41906.61	52.60	
		5	39412.78	110.42				3	41985.93	79.32	
								4	42092.52	106.59	
3d³(a ²H)4p	x ³H°	4	39115.99		0.88?	3d² 4s(a ⁴F)4d	e ⁵H	3	41823.19		
		5	39152.14	36.15	1.02			4	41917.05	93.86	
		6	39198.39	46.25	1.18			5	42018.01	100.96	1.15
3d³(a ²P)4p	w ¹D°	2	39265.80		1.06:			6	42123.77	105.76	1.22
								7	42205.59	81.82	1.28
3d³(b ⁴F)5s	f ³F	2	39526.89			3d² 4s(a ⁴F)4d	e ⁵D	0	41871.56		
		3	39640.98	114.09				1	41901.36	29.80	
		4	39785.94	144.96				2	41958.51	57.15	
3d³(a ⁴P)4p	s ³D°	1	39662.15		0.52			3	42052.72	94.21	
		2	39686.10	23.95				4	42184.66	131.94	
		3	39715.51	29.41	1.31:	3d² 4s(a ⁴F)4d	g ³F	2	41871.87		
3d³(b ²D)4p	w ¹F°	3	40303.04		1.05:			3	41988.39	116.52	
3d³(a ²H)4p	z ¹I°	6	40319.80		1.03			4	42107.06	118.67	
3d³(a ⁴P)4p:	v ³P°	0	40369.76			3d³(a ²P)4p:	u ³P°	2	41928.59		
		1	40384.58	14.82				1	41943.95	−15.36	
		2	40467.04	82.46				0	41959.46	−15.51	
3d³(a ²P)4p	r ³D°	1	40556.07		0.49		q ³D°	1	42146.39		
		2	40670.60	114.53				2	42206.88	60.49	
		3	40844.19	173.59				3	42311.31	104.43	1.32
3d³(a ²P)4p	x ³S°	1	40844.19				p ³D°	1	42193.94		
	w ¹G°	4	40883.30		0.95:			2	42269.73	75.79	
								3	42376.71	106.98	
3d³(a ²G)4p:	y ¹H°	5	41039.93		1.03	3d² 4s(a ⁴F)4d	e ⁵P	1	42611.58		
3d² 4s(a ²F)5s	e ¹F	3	41087.31		1.01			2	42724.11	112.53	
3d³(a ²H)4p	u ³G°	3	41169.82		0.73			3	42858.90	134.79	1.64
		4	41255.44	85.62	1.03	3d² 4s(a ²S)4p:	w ¹P°	1	42927.55		1.00:
		5	41341.62	86.18	1.19	3d² 4s(a ⁴F)4d	g ⁵F	1	43034.08		
3d² 4s(a ⁴F)4d	e ³G	3	41194.42					2	43080.92	46.84	
		4	41368.86	174.44				3	43148.15	67.23	
		5	41481.13	112.27				4	43231.99	83.84	
	s ³F°	2	41337.43		0.66			5	43330.07	98.08	
		3	41457.62	120.19	1.09		r ³F°	2	43467.55		
		4	41624.13	166.51	1.24			3	43583.14	115.59	
3d² 4s(a ⁴F)4d	e ³H	4	41515.09					4	43744.55	161.41	
		5	41556.33	41.24		3d³(a ²H)4p:	v ¹G°	4	43674.31		0.95
		6	41615.02	58.69			v ¹D°	2	43710.28		
3d³ (a²G)4p:	v ¹F⁰	3	41585.24			3d³(b ²D)4p	u ¹D°	2	43799.57		0.98:
3d² 4s(a ⁴F)4d	e ⁵G	2	41714.35			3d³(b ⁴F)4d	f ⁵H	3	43843.82		
		3	41757.47	43.12				4	43901.74	57.92	0.91
		4	41818.70	61.23	1.12			5	43971.55	69.81	1.11
		5	41903.48	84.78	1.24			6	44051.37	79.82	1.21
		6	42019.22	115.74	1.34			7	44134.65	83.28	1.29
							o ³D°	1	43975.62		
								2	44079.39	103.77	
								3	44233.15	153.76	1.18?

Ti I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
	t ³G°	3			
		4	*44162.44*		
		5	*44375.57*	213.13	
3d³(a ²H)4p	x ¹H°	5	*44163.24*		1.03
3d³(b ⁴F)4d	f ⁵D	0			
		1			
		2			
		3	44254.39	126.78	
		4	44381.17		
3d² 4s(a ²D)5s	e ¹D	2	44581.16		
	q ³F°	2	*44825.26*	97.74	
		3	*44923.00*	118.02	
		4	*45041.02*		
3d³(a ⁴P)4p	w ³S°	1	*44857.89*		
	n ³D°	1	*44966.36*	97.58	
		2	*45063.94*	142.40	
		3	*45206.34*		
3d² 4s(a ²S)4p:	t ³P°	0	*45040.70*	50.03	
		1	*45090.73*	87.33	
		2	*45178.06*		
3d² 4s(a ²F)4d	e ¹H	5	45485.35		
3d³(b ⁴F)4d?	f ⁵G	2			
		3	45689.89	21.39	
		4	45711.28	45.17	
		5	45756.45?	148.28	
		6	45904.73		
3d² 4s(a ²F)4d	f ³H	4	45721.89	110.61	0.80
		5	45832.50	127.89	1.03
		6	45960.39		1.17
3d² 4s(a ⁴F)6s	h ⁵F	1	45764.71	48.30	
		2	45813.01	80.25	
		3	45893.26	114.36	
		4	46007.62	150.14	
		5	46157.76		
3d² 4s(a ²F)4d	e ¹G	4	46068.04		
3d² 4s(b ⁴P)5s	e ³P	0			
		1			
		2	46244.60		
3d³(b ²F)4p:	u ¹G°	4	*46257.67*		0.95
3d² 4s(a ⁴F)6s	h ³F	2			
		3			
		4	46530.45		
3d² 4s(a ²F)4d	f ¹F	3	46650.26		
3d² 4p²	g ⁵G	2	46943.91	86.37	
		3	47030.28	109.58	
		4	47139.86	140.83	
		5	47280.69	166.15	
		6	47446.84		

Ti I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
3d² 4s(a ²F)4d	i ³F	2			
		3	47038.16	156.52	
		4	47194.68		
3d³(b ⁴F)6s	i ⁵F	1			
		2			
		3			
		4			
		5	47777.32		
3d² 4s(a ⁴F)5d	g ⁵H	3	47840.62	72.99	
		4	47913.61	80.71	
		5	47994.32	112.51	
		6	48106.83	156.00	
		7	48262.83		
3d² 4s(a ⁴F)5d	h ⁵G	2	47870.61	66.18	
		3	47936.79	81.29	
		4	48018.08	101.39	
		5	48119.47	114.00	
		6	48233.47		
3d² 4p²	j ⁵F	1	48058.85	48.57	
		2	48107.42	101.45	
		3	48208.87	119.94	
		4	48328.81	133.30	
		5	48462.11		
3d² 4s(a ⁴F)5d	g ⁵D	0			
		1			
		2			
		3	48059.82	126.29	
		4	48186.11		
3d³(b ²F)4p:	u ¹F°	3	*48365.09*		
3d² 4s(a ⁴F)5d	k ⁵F	1			
		2	48519.21	69.07	
		3	48588.28	84.38	
		4	48672.66	99.07	
		5	48771.73		
3d² 4p²	e ³D	1	48724.83	−0.49	
		2	48724.34	115.40	
		3	48839.74		
3d² 4p²	h ⁵D	0	48802.32	57.19	
		1	48859.51	55.56	
		2	48915.07	109.36	
		3	49024.43	12.03	
		4	49036.46		
	f ³D	1			
		2	49571.69	48.03	
		3	49619.72		
	f ¹D	2	50128.08		
	f ¹G	4	52125.98		
	e ¹P	1	53663.32		
Ti II (a ⁴F₁½)	*Limit*	-----	55138		

June 1948.

Ti I Observed Terms

Config. 1s² 2s² 2p⁶ 3s² 3p⁶+	Observed Terms			
$3d^2\,4s^2$	a ²P	a ¹D	a ³F	a ¹G
$3d^4$	d ³P	a ⁵D	b ³G	
$3d^2\,4p^2$	h ⁵D / e ³D	i ⁵F	g ⁵G	

Config.	ns (n ≥ 4)	np (n ≥ 4)				
$3d^2\,4s(a\,{}^4F)nx$	e, h ⁵F e, h ³F		z, v ⁵D° y ³D°	z ⁵F° y ³F°	z ⁵G° x ³G°	
$3d^3(b\,{}^4F)nx$	a, f, i ⁵F b, f ³F		x ⁵D° x ³D°	y ⁵F° x ³F°	y ⁵G° y ³G°	
$3d^2\,4s(a\,{}^2F)nx$	e ¹F		z ³D° z ¹D°	z ³F° z ¹F°	z ³G° z ¹G°	
$3d^2\,4s(a\,{}^2D)nx$	e ¹D	y ³P° z ¹P°	v ³D° y ¹D°	w ³F° y ¹F°		
$3d^3(a\,{}^2G)nx$	a ³G b ¹G			t ³F° v ¹F°	v ³G° x ¹G°	y ³H° y ¹H°
$3d^3(a\,{}^4P)nx$	a ⁵P c ³P	y ⁵S° w ³S°	y ⁵P° v ³P°	w ⁵D° s ³D°		
$3d^3(a\,{}^2P)nx$	b ³P a ¹P	x ³S° z ¹S°	u ³P°	r ³D° w ¹D°		
$3d^2\,4s(b\,{}^4P)nx$	e ³P	z ⁵S° z ³S°	z ⁵P° z ³P°	y ⁵D° w ³D°		
$3d^3(b\,{}^2D)nx$	a ³D b ¹D		w ³P° x ¹P°	t ³D° u ¹D°	u ³F° w ¹F°	
$3d^3(a\,{}^2H)nx$	a ³H a ¹H			u ³G° v ¹G°	x ³H° x ¹H°	z ³I° z ¹I°
$3d^2\,4s(b\,{}^2G)nx$				v ³F° x ¹F°	w ³G° y ¹G°	z ³H° z ¹H°
$3d^2\,4s(b\,{}^2P)nx$		y ³S°	x ³P° y ¹P°	u ³D° x ¹D°		
$3d^3(b\,{}^2F)nx$	a ¹F			u ¹F°	u ¹G°	
$3d^2\,4s(a\,{}^2S)nx$		t ³P° w ¹P°				

Config.	nd (n ≥ 4)				
$3d^2\,4s(a\,{}^4F)nx$	e ⁵P	e, g ⁵D	g, k ⁵F g ³F	e, h ⁵G e ³G	e, g ⁵H e ³H
$3d^3(b\,{}^4F)nx$		f ⁵D		f ⁵G?	f ⁵H
$3d^2\,4s(a\,{}^2F)nx$			i ³F f ¹F	e ¹G	f ³H e ¹H

*For predicted terms in the spectra of the Ti I isoelectronic sequence, see Introduction.

Ti II

(Sc I sequence; 21 electrons) $Z=22$

Ground state $1s^2\, 2s^2\, 2p^6\, 3s^2\, 3p^6\, 3d^2\, 4s\ {}^4F_{1\frac{1}{2}}$

$a\ {}^4F_{1\frac{1}{2}}$ **110000 cm^{-1}**   I. P. 13.63 volts

This spectrum has been analyzed by Russell. His detailed analysis published in 1927 contains 50 terms derived from 164 multiplets, and includes 529 classified lines. The doublet and quartet terms are connected by observed intersystem combinations.

The configuration assignments are of considerable theoretical interest, as indicated, for example, in the references to the papers by Ufford, Racah, and Many listed below. Many has interchanged the configurations given by Russell to the two low ${}^4F$ terms. From a detailed study of the series relations Russell has recently shown conclusively that his original assignments were correct, namely that the lower term ($a\ {}^4F$) has the configuration $3d^2\ (a\ {}^3F)4s$ and that the higher one ($b\ {}^4F$) should be ascribed to $3d^3$.

Approximate g-values have been determined by Catalán from the Zeeman patterns observed by King and Babcock and quoted by Russell (1927). Very few patterns have been resolved and consequently the observed g-values differ from the theoretical ones by a few percent in some cases. Colons indicate that LS-coupling has been assumed and a theoretical g-value introduced in order to utilize the observed data. It is highly desirable to extend this work with the aid of Harrison's unpublished Zeeman observations of titanium.

REFERENCES

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H. N. Russell, Phys. Rev. **74**, 689 (1948).
M. A. Catalán, unpublished material (June 1948).   (Z E)

Ti II

Config.	Desig.	J	Level	Interval	Obs. g
$3d^2(a\ {}^3F)4s$	$a\ {}^4F$	$1\frac{1}{2}$	0.00	93.94	
		$2\frac{1}{2}$	93.94	131.53	
		$3\frac{1}{2}$	225.47	167.75	
		$4\frac{1}{2}$	393.22		
$3d^3$	$b\ {}^4F$	$1\frac{1}{2}$	907.96	75.84	
		$2\frac{1}{2}$	983.80	103.41	
		$3\frac{1}{2}$	1087.21	128.37	
		$4\frac{1}{2}$	1215.58		
$3d^2(a\ {}^3F)4s$	$a\ {}^2F$	$2\frac{1}{2}$	4628.61	268.99	0.86:
		$3\frac{1}{2}$	4897.60		1.14:
$3d^2(a\ {}^1D)4s$	$a\ {}^2D$	$1\frac{1}{2}$	8710.47	33.80	0.80
		$2\frac{1}{2}$	8744.27		1.20:
$3d^3$	$a\ {}^2G$	$3\frac{1}{2}$	8997.69	120.46	0.89:
		$4\frac{1}{2}$	9118.15		1.11:

Ti II

Config.	Desig.	J	Level	Interval	Obs. g
$3d^3$	$a\ {}^4P$	$\frac{1}{2}$	9363.71	32.05	2.63
		$1\frac{1}{2}$	9395.76	122.29	1.74
		$2\frac{1}{2}$	9518.05		1.60:
$3d^3$	$a\ {}^2P$	$\frac{1}{2}$	9850.90	125.02	0.66
		$1\frac{1}{2}$	9975.92		1.33
$3d^2(a\ {}^3P)4s$	$b\ {}^4P$	$\frac{1}{2}$	9872.87	57.87	2.60
		$1\frac{1}{2}$	9930.74	94.00	1.72:
		$2\frac{1}{2}$	10024.74		1.60:
$3d^3$	$b\ {}^2D$	$1\frac{1}{2}$	12628.77	129.38	0.80:
		$2\frac{1}{2}$	12758.15		1.20:
$3d^3$	$a\ {}^2H$	$4\frac{1}{2}$	12676.99	97.82	0.91:
		$5\frac{1}{2}$	12774.81		1.09:
$3d^2(a\ {}^1G)4s$	$b\ {}^2G$	$4\frac{1}{2}$	15257.53	-8.07	1.11:
		$3\frac{1}{2}$	15265.60		0.89:

Config.	Desig.	J	Level	Interval	Obs. g	Config.	Desig.	J	Level	Interval	Obs. g
3d²(a ³P)4s	b ²P	½	16515.79	109.46	0.66	3d²(a ¹G)4p	x ²F°	3½	47466.80	−158.37	1.14:
		1½	16625.25		1.33			2½	47625.17		0.86:
3d³	b ²F	3½	20891.88	−59.89	1.14:	3d 4s(a ³D)4p	x ⁴D°	½	52329.78	129.20	
		2½	20951.77		0.86:			1½	52458.98	12.50	
3d²(a ¹S)4s	a ²S	½	21338.00:					2½	52471.48	159.59	
								3½	52631.07		
3d 4s²	c ²D	1½	24961.34	231.70	0.80:	3d 4s(a ³D)4p	x ²P°	½	53121.48	6.69	
		2½	25193.04		1.20:			1½	53128.17		
3d²(a ³F)4p	z ⁴G°	2½	29544.37	190.08	0.57:	3d 4s(a ³D)4p	w ²D°	2½	53554.90	−41.80	
		3½	29734.45	233.63	0.98:			1½	53596.70		
		4½	29968.08	272.60		3d 4s(a ³D)4p	y ⁴P°	½	56223.13	25.98	
		5½	30240.68					1½	56249.11	76.83	
3d²(a ³F)4p	z ⁴F°	1½	30836.52	122.18	0.40:			2½	56325.94		
		2½	30958.70	154.91	1.03:	3d 4s(a ³D)4p	w ²F°	2½	59321.79	146.02	
		3½	31113.61	187.31	1.24:			3½	59467.81		
		4½	31300.92								
3d²(a ³F)4p	z ²F°	2½	31207.44	283.38	0.86:	3d²(a ³F)5s	e ⁴F	1½	62180.02	91.23	
		3½	31490.82		1.14:			2½	62271.25	138.33	
3d²(a ³F)4p	z ²D°	1½	31756.50	269.00	0.92			3½	62409.58	184.69	
		2½	32025.50		1.20			4½	62594.27		
3d²(a ³F)4p	z ⁴D°	½	32532.38	70.13	0.00	3d²(a ³F)5s	e ²F	2½	63168.23	276.53	
		1½	32602.51	95.43	1.20			3½	63444.76		
		2½	32697.94	69.08	1.37	3d²(a ³F)4d	e ⁴G	2½	64884.65	92.92	
		3½	32767.02		1.43:			3½	64977.57	116.72	
3d²(a ³F)4p	z ²G°	3½	34543.36	205.14	0.89:			4½	65094.29	147.31	
		4½	34748.50		1.11:			5½	65241.60		
3d²(a ³P)4p	z ²S°	½	37430.55		2.09	3d²(a ³F)4d	e ⁴H	3½	65184.72	122.73	
3d²(a ¹D)4p	y ²D°	1½	39233.44	243.43	0.80:			4½	65307.45	138.40	
		2½	39476.87		1.20:			5½	65445.85	143.25	
3d³(a ¹D)4p	z ²P°	1½	39602.90	−71.74	1.21			6½	65589.10		
		½	39674.64		0.67:	3d²(a ³F)4d	f ²F	2½	65312.71	145.94	
3d²(a ¹D)4p	y ²F°	2½	39926.83	147.88	0.86:			3½	65458.65		
		3½	40074.71		1.14:	3d²(a ³F)4d	e ⁴D	½	66767.43?	49.06	
3d²(a ³P)4p	z ⁴S°	1½	40027.28					1½	66816.49	121.21	
3d²(a ³P)4p	y ⁴D°	½	40330.25	95.55				2½	66937.70	58.97	
		1½	40425.80	156.00				3½	66996.67		
		2½	40581.80	216.57		3d²(a ³F)4d	e ²G	3½	67604.20	216.67	
		3½	40798.37					4½	67820.87		
3d²(a ³P)4p	z ⁴P°	½	41996.74	72.11		3d²(a ³F)4d	e ²H	4½	68328.95	253.39	
		1½	42068.85	139.99				5½	68582.34		
		2½	42208.84			3d²(a ³F)4d	f ⁴F	1½	68767.66	77.48	
3d²(a ¹G)4p	y ²G°	3½	43740.77	40.22	0.89:			2½	68845.14	105.25	
		4½	43780.99		1.11:			3½	68950.39	130.96	
3d²(a ³P)4p	x ²D°	2½	44902.42	−12.38	1.20:			4½	69081.35		
		1½	44914.80		0.80:	3d 4s(b ¹D)4p	v ²D°	1½	69327.32	294.83	
3d²(a ³P)4p	y ²P°	½	45472.89	76.01	0.66:			2½	69622.15		
		1½	45548.90		1.33:	3d 4s(b ¹D)4p	v ²F°	2½	70606.35	286.65	
3d²(a ¹G)4p	z ²H°	4½	45673.75	234.81				3½	70893.00		
		5½	45908.56			Ti III (a ³F₂)	**Limit**	-----	**110000**		

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Observed Terms		
$3d^3$	$\{$ $a\ ^4P$ $b\ ^4F$ $a\ ^2P$ $b\ ^2D$ $b\ ^2F$ $a\ ^2G$ $a\ ^2H$		
$3d\,4s^2$	$c\ ^2D$		

	$ns\ (n\geq 4)$	$np\ (n\geq 4)$	$nd\ (n\geq 4)$

$3d^2(a\ ^3F)nx$	$\{$ $a,\,e\ ^4F$
	     $a,\,e\ ^2F$
		$z\ ^4D^\circ$ $z\ ^4F^\circ$ $z\ ^4G^\circ$
		 $z\ ^2D^\circ$ $z\ ^2F^\circ$ $z\ ^2G^\circ$
			$e\ ^4D$ $f\ ^4F$ $e\ ^4G$ $e\ ^4H$
			        $f\ ^2F$ $e\ ^2G$ $e\ ^2H$

$3d^2(a\ ^1D)nx$	$a\ ^2D$	$z\ ^2P^\circ$ $y\ ^2D^\circ$ $y\ ^2F^\circ$	
$3d^2(a\ ^3P)nx$	$\{$ $b\ ^4P$ $b\ ^2P$	$z\ ^4S^\circ$ $z\ ^4P^\circ$ $y\ ^4D^\circ$ $z\ ^2S^\circ$ $y\ ^2P^\circ$ $x\ ^2D^\circ$	
$3d^2(a\ ^1S)nx$	$a\ ^2S$		
$3d^2(a\ ^1G)nx$	$b\ ^2G$	$x\ ^2F^\circ$ $y\ ^2G^\circ$ $z\ ^2H^\circ$	
$3d\,4s(a\ ^3D)nx$	$\{$	$y\ ^4P^\circ$ $x\ ^4D^\circ$ $x\ ^2P^\circ$ $w\ ^2D^\circ$ $w\ ^2F^\circ$	
$3d\,4s(b\ ^1D)nx$		$v\ ^2D^\circ$ $v\ ^2F^\circ$	

*A chart of predicted terms in the spectra of the Sc I isoelectronic sequence is given in the Introduction. Owing to the difference in binding energies of the $3d$ and $4s$ electrons along this sequence, the charts of observed and predicted terms are not similarly arranged for Ti II.

Ti III

(Ca I sequence; 20 electrons) $Z=22$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^2\ ^3F_2$

$a\ ^3F_2$ **227000** cm^{-1} I. P. 28.14 volts

     The analysis is by Russell and Lang who have classified 84 lines in the interval between 1002 A and 2984 A.

     The singlet and triplet terms are connected by observed intersystem combinations.

REFERENCE

H. N. Russell and R. J. Lang, Astroph. J. **66,** 25 ; Mt. Wilson Contr. No. 337 (1927). (I P) (T) (C L)

Ti III

Config.	Desig.	J	Level	Interval
$3d^2$	$a\ ^3F$	2 3 4	0. 0 183. 7 421. 9	183. 7 238. 2
$3d^2$	$a\ ^1D$	2	8472. 6	
$3d^2$	$a\ ^3P$	0 1 2	10536. 4 10603. 5 10721. 1	67. 1 117. 6
$3d^2$	$a\ ^1S$	0	14052. 7?	
$3d^2$	$a\ ^1G$	4	14398. 5	
$3d(^2D)4s$	$a\ ^3D$	1 2 3	38063. 50 38197. 98 38425. 19	134. 48 227. 21
$3d(^2D)4s$	$b\ ^1D$	2	41703. 65	
$3d(^2D)4p$	$z\ ^1D°$	2	75197. 43	
$3d(^2D)4p$	$z\ ^3D°$	1 2 3	76999. 70 77166. 65 77424. 20	166. 95 257. 55
$3d(^2D)4p$	$z\ ^3F°$	2 3 4	77421. 48 77746. 18 78158. 71	324. 70 412. 53
$3d(^2D)4p$	$z\ ^3P°$	0 1 2	80943. 95 80938. 02 81023. 60	−5. 93 85. 58

Ti III

Config.	Desig.	J	Level	Interval
$3d(^2D)4p$	$z\ ^1F°$	3	83116. 58	
$3d(^2D)4p$	$z\ ^1P°$	1	83795. 70	
$3d(^2D)4d$	$e\ ^3G$	3 4 5	129096. 3 129256. 0 129472. 6	159. 7 216. 6
$3d(^2D)4d$	$e\ ^3D$	1 2 3	129873. 9 130019. 5	145. 6
$3d(^2D)4d$	$e\ ^3S$	2	132854. 6	
$3d(^2D)4d$	$e\ ^3F$	2 3 4	133067. 2 133209. 7 133373. 7	142. 5 164. 0
$3d(^2D)4d$	$e\ ^3P$	0 1 2	135543. 8 135602. 4 135724. 1	58. 6 121. 7
$4s(^2S)4p$	$y\ ^3P°$	0 1 2	137262 137490 137971	228 481
Ti IV $(^2D)_{1\frac{1}{2}}$	Limit		227000	

June 1948.

Ti III Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6+$	Observed Terms		
$3d^2$	$\{a\ ^1S \quad a\ ^3P \quad a\ ^1D \quad a\ ^3F \quad a\ ^1G$		
	ns (n ≥ 4)	np (n ≥ 4)	nd (n ≥ 4)
$3d(^2D)nx$	$a\ ^3D$ $b\ ^1D$	$z\ ^3P° \quad z\ ^3D° \quad z\ ^3F°$ $z\ ^1P° \quad z\ ^1D° \quad z\ ^1F°$	$e\ ^3S \quad e\ ^3P \quad e\ ^3D \quad e\ ^3F \quad e\ ^3G$
$4s(^2S)nx$		$y\ ^3P°$	

*A chart of predicted terms in the spectra of the Ca I isoelectronic sequence is given in the Introduction. Owing to the change in binding energies of the $3d$ and $4s$ electrons along this sequence, the arrangement of the charts of observed and predicted terms is not identical. In Ti III no primes are used to indicate higher limits, and the prefixes a, b ... e, z, y replace those indicating the running electron.

Ti IV

(K I sequence; 19 electrons) $Z=22$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d\ ^2D_{1\frac{1}{2}}$

$3d\ ^2D_{1\frac{1}{2}}$ 348817.8 cm^{-1} I. P. 43.24 volts

The analysis is from Russell and Lang, who have revised and extended the early work of Gibbs and White. Thirty-one lines have been classified in the range between 423 A and 5492 A.

REFERENCES

R. C. Gibbs and H. E. White, Proc. Nat. Acad. Sci. **12**, 598 (1926). (T) (C L)

H. N. Russell and R. J. Lang, Astroph. J. **66**, 15 (1927); Mt. Wilson Contr. No. 337 (1927). (I P) (T) (C L)

Ti IV   Ti IV

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3p^6(^1S)3d$	$3d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	0. 0 384. 3	384. 3	$3p^6(^1S)5d$	$5d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	258827. 2 258866. 7	39. 5
$3p^6(^1S)4s$	$4s\ ^2S$	$\frac{1}{2}$	80378. 6		$3p^6(^1S)6s$	$6s\ ^2S$	$\frac{1}{2}$	265835. 8	
$3p^6(^1S)4p$	$4p\ ^2P°$	$\frac{1}{2}$ $1\frac{1}{2}$	*127912. 5* *128730. 9*	818. 4	$3p^6(^1S)5g$	$5g\ ^2G$	$\{\ ^{3\frac{1}{2}}_{4\frac{1}{2}}\ \}$	278501. 1	
$3p^6(^1S)4d$	$4d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	196794. 8 196880. 5	85. 7	$3p^6(^1S)6h$	$6h\ ^2H°$	$\{\ ^{4\frac{1}{2}}_{5\frac{1}{2}}\ \}$	*300012. 5*	
$3p^6(^1S)5s$	$5s\ ^2S$	$\frac{1}{2}$	212395. 8		$3p^6(^1S)7h$	$7h\ ^2H°$	$\{\ ^{4\frac{1}{2}}_{5\frac{1}{2}}\ \}$	*312973. 5*	
$3p^6(^1S)5p$	$5p\ ^2P°$	$\frac{1}{2}$ $1\frac{1}{2}$	*230597. 6* *230913. 4*	315. 8					
$3p^6(^1S)4f$	$4f\ ^2F°$	$2\frac{1}{2}$ $3\frac{1}{2}$	*236125. 3* *236132. 5*	7. 2	Ti V $(^1S_0)$	*Limit*		348817. 8	

May 1948.

Ti V

(A I sequence; 18 electrons) $Z=22$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,{}^1S_0$

$3p^6\,{}^1S_0$ 805500 cm^{-1} I. P. 99.8 volts

Four lines are classified in the region between 163 A and 228 A, as combinations with the ground term. The levels in the table are from the 1937 reference, and all values have been rounded off in the last places.

For convenience, the Paschen notation has been added by the writer in column one of the table, under the heading "A I". As for A I, the jl-coupling notation in the general form suggested by Racah is here introduced, although LS-designations, as indicated in column two under the heading "Authors", are perhaps preferable for the terms thus far identified.

REFERENCES

P. G. Kruger and S. G. Weissberg, Phys. Rev. **48**, 659 (1935).   (C L)
P. G. Kruger, S. G. Weissberg and L. W. Phillips, Phys. Rev. **51**, 1090 (1937).   (I P) (T) (C L)
G. Racah, Phys. Rev. **61**, 537 (L) (1942).

Ti V

A I	Authors	Config.	Desig.	J	Level
$1p_0$	$3p^6\,{}^1S$	$3p^6$	$3p^6\,{}^1S$	0	0
$1s_4$	$3p^5\,4s\;{}^3P^\circ$	$3p^5({}^2P^\circ_{1\frac12})4s$	$4s\,[1\frac12]^\circ$	2 / 1	436880
$1s_2$	$3p^5\,4s\;{}^1P^\circ$	$3p^5({}^2P^\circ_{\frac12})4s$	$4s'[\,\frac12]^\circ$	0 / 1	443780
$2s_4$	$3p^5\,5s\;{}^3P^\circ$	$3p^5({}^2P^\circ_{1\frac12})5s$	$5s\,[\,\frac12]^\circ$	2 / 1	608090
$2s_2$	$3p^5\,5s\;{}^1P^\circ$	$3p^5({}^2P^\circ_{\frac12})5s$	$5s'[\,\frac12]^\circ$	0 / 1	612970
		Ti VI ($^2P^\circ_{1\frac12}$)	*Limit*	-----	805500
		Ti VI ($^2P^\circ_{\frac12}$)	*Limit*	-----	811330

May 1948.

Ti VI

(Cl I sequence; 17 electrons) $Z=22$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5\ {}^2\text{P}^{\circ}_{1\frac{1}{2}}$

$3p^5\ {}^2\text{P}^{\circ}_{1\frac{1}{2}}\ \mathit{966000}$ cm^{-1} I. P. 120 volts

     All of the terms except $3p^6\ {}^2\text{S}$ are from the paper by Edlén. Twelve lines in the region between 182 A and 524 A have been classified as combinations from the ground term. Edlén has estimated the value of the limit by extrapolation along the isoelectronic sequence, as indicated by brackets in the table. His unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

S. G. Weissberg and P. G. Kruger, Phys. Rev. **49**, 872 (A) (1936). (C L)
B. Edlén, Zeit. Phys. **104**, 407 (1937). (I P) (T) (C L)

Ti VI

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^5$	$3p^5\ {}^2\text{P}^{\circ}$	$1\frac{1}{2}$ $\frac{1}{2}$	*0* *5840*	-5840
$3s\ 3p^6$	$3p^6\ {}^2\text{S}$	$\frac{1}{2}$	196620	
$3s^2\ 3p^4({}^3\text{P})4s$	$4s\quad {}^4\text{P}$	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	495390	
$3s^2\ 3p^4({}^2\text{P})4s$	$4s\quad {}^2\text{P}$	$1\frac{1}{2}$ $\frac{1}{2}$	502580 506440	-3860
$3s^2\ 3p^4({}^1\text{D})4s$	$4s'\quad {}^2\text{D}$	$2\frac{1}{2}$ $1\frac{1}{2}$	518820 518930	-110
$3s^2\ 3p^4({}^1\text{S})4s$	$4s''\ {}^2\text{S}$	$\frac{1}{2}$	549000	
-----------	------	---	---------	
Ti VII $({}^3\text{P}_2)$	*Limit*	---	*[966000]*	

January 1948.

Ti VII

(S I sequence; 16 electrons) $Z=22$

Ground state $1s^2\, 2s^2\, 2p^6\, 3s^2\, 3p^4\ ^3P_2$

$3p^4\ ^3P_2$ **1136000** cm^{-1} I. P. 140.8 volts

All the terms are from Edlén's paper except $3p^5\ ^3P°$, which is from Kruger and Pattin, who have estimated the value entered in brackets in the table. Twenty-four lines have been classified in the region between 164 A and 200 A. The limit is from Edlén, who has extrapolated it from isoelectronic sequence data.

The singlet and triplet terms are connected by two observed intersystem combinations. The unit adopted by Edlén, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

B. Edlén, Zeit. Phys. **104,** 188 (1937). (I P) (T) (C L)
P. G. Kruger and H. S. Pattin, Phys. Rev. **52,** 622 (1937). (T) (C L)

Ti VII

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\, 3p^4$	$3p^4\ ^3P$	2 1 0	0 4540 5900	-4540 -1360	$3s^2\, 3p^3(^2D°)4s$	$4s'\ ^1D°$	2	592930	
					$3s^2\, 3p^3(^2P°)4s$	$4s''\ ^3P°$	0 1 2	607550 607990 609120	440 1130
$3s^2\, 3p^4$	$3p^4\ ^1D$	2	24120						
$3s^2\, 3p^4$	$3p^4\ ^1S$	0	54770		$3s^2\, 3p^3(^2P°)4s$	$4s''\ ^1P°$	1	614790	
$3s\ 3p^5$	$3p^5\ ^3P°$	2 1 0	196260 200060 [202200]	-3800 $-[2140]$	Ti VIII $(^4S^°_{1½})$	*Limit*		1136000	
$3s^2\, 3p^3(^4S°)4s$	$4s\ ^3S°$	1	564240						
$3s^2\, 3p^3(^2D°)4s$	$4s'\ ^3D°$	1 2 3	586100 586320 587000	220 680					

January 1948.

Ti VIII

(P I sequence; 15 electrons)   Z=22

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3\ {}^4\mathrm{S}^{\circ}_{1\frac{1}{2}}$

$3p^3\ {}^4\mathrm{S}^{\circ}_{1\frac{1}{2}}$ cm^{-1} I. P.   volts

The analysis is incomplete. Kruger and Pattin have observed 15 lines between 150 A and 162 A and arranged them in five multiplets that give intervals consistent with those found in related isoelectronic spectra.

By a rough extrapolation of $3p^3\ {}^4\mathrm{S}^{\circ}_{1\frac{1}{2}}-3p^3\ {}^2\mathrm{D}^{\circ}_{1\frac{1}{2}}$ along the isoelectronic sequence the writer has estimated the value of $3p^3\ {}^2\mathrm{D}^{\circ}_{1\frac{1}{2}}$ entered in brackets in the table. She has calculated the terms listed below from the observed multiplets. The uncertainty x in the estimated position of the doublet terms relative to the quartets may well exceed ± 500 cm^{-1}.

REFERENCE

P. G. Kruger and H. S. Pattin, Phys. Rev. **52**, 624 (1937). (C L)

Ti VIII

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^3$	$3p^3\ {}^4\mathrm{S}^{\circ}$	$1\frac{1}{2}$	*0*	
$3s^2\ 3p^3$	$3p^3\ {}^2\mathrm{D}^{\circ}$	$1\frac{1}{2}$	*[33000]+x*	
		$2\frac{1}{2}$	*34080 +x*	1080
$3s^2\ 3p^3$	$3p^3\ {}^2\mathrm{P}^{\circ}$	$\frac{1}{2}$	*55000*	
		$1\frac{1}{2}$	*56460*	1460
$3s^2\ 3p^2({}^3\mathrm{P})4s$	$4s\ {}^4\mathrm{P}$	$\frac{1}{2}$	*660130*	
		$1\frac{1}{2}$	*662850*	2720
		$2\frac{1}{2}$	*666500*	3650
$3s^2\ 3p^2({}^3\mathrm{P})4s$	$4s\ {}^2\mathrm{P}$	$\frac{1}{2}$	*672220 +x*	
		$1\frac{1}{2}$	*676450 +x*	4230
$3s^2\ 3p^2({}^1\mathrm{D})4s$	$4s'\ {}^2\mathrm{D}$	$2\frac{1}{2}$	*691260 +x*	
		$1\frac{1}{2}$	*691490 +x*	-230

December 1947.

Ti IX

(Si I sequence; 14 electrons)   Z=22

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2\ {}^3P_0$

$3p^2\ {}^3P_0$ 1560000 cm^{-1} I. P. 193 volts

  The analysis is very incomplete, but seven lines have been classified by Phillips in the interval 281 A to 341 A as combinations among three triplet terms. He states that the interval $3p^2\ {}^3P_0 - 3p^2\ {}^3P_1$ of the ground term has been extrapolated along the sequence, since no combinations from the ground state $3p^2\ {}^3P_0$ are known. The first interval is, therefore, entered in brackets in the table, as well as his estimated value of the limit.

REFERENCE

L. W. Phillips, Phys. Rev. **55,** 709 (1939). (I P) (T) (C L)

Ti IX

Config.	Desig.	J	Level	Interval
$3s^2\ 3p^2$	$3p^2\ {}^3P$	0 1 2	0 3100 7310	[3100] 4210
$3s\ \ 3p^3$	$3p^3\ {}^3S°$	1	299920	
$3s^2\ 3p({}^2P°)3d$	$3d\ \ {}^3P°$	2 1 0	352460 356800 358380	-4340 -1580
------------	------	---	-------	
Ti x $({}^2P°_{1/2})$	*Limit*	---	[1560000]	

October 1947.

Ti X

(Al I sequence; 13 electrons)   Z=22

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p\ {}^2P°_{1/2}$

$3p\ {}^2P°_{1/2}$ cm^{-1} I. P.   volts

  This spectrum has not been analyzed, but Edlén has classified two lines as follows:

I. A.	Int.	Wave No.	Desig.
101. 355	[2]	986630	$\Big\}\,3p\ {}^2P° - 4d\ {}^2D$
102. 107	2	979360	

His unit, 10^3 cm^{-1}, is here changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **103,** 540 (1936). (C L)

December 1947.

Ti XI

(Mg I sequence; 12 electrons) $Z=22$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,{}^1S_0$

$3s^2\,{}^1S_0$ **2142000** cm^{-1} I. P. 266 volts

Edlén has classified 14 lines in the region between 71 A and 126 A. No intersystem combinations have been observed and the triplet terms are not all connected by observed combinations. He has determined the relative positions of the various groups of terms and also the ionization potential by extrapolation along the isoelectronic sequence. His estimated value of the limit is entered in brackets in the table.

His unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **103,** 536 (1936). (I P) (T) (C L)

Ti XI

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2$	$3s^2\,{}^1S$	0	0		$3s({}^2S)4f$	$4f\,{}^3F^\circ$	2		
$3s({}^2S)3p$	$3p\,{}^3P^\circ$	0	$172370+x$	2550			3		
		1	$174920+x$	5630			4	$1297420+x$	
		2	$180550+x$		$3s({}^2S)5d$	$5d\,{}^3D$	1		
$3s({}^2S)3d$	$3d\,{}^3D$	1					2		
		2					3	$1577370+x$	
		3	$504150+x$		$3s({}^2S)5f$	$5f\,{}^3F^\circ$	2		
$3s({}^2S)4s$	$4s\,{}^3S$	1	$1050030+x$				3		
$3s({}^2S)4p$	$4p\,{}^1P^\circ$	1	1139970				4	$1603570+x$	
$3s({}^2S)4d$	$4d\,{}^3D$	1	$1243080+x$	270	Ti XII $({}^2S_{1/2})$	*Limit*		[2142000]	
		2	$1243350+x$	420					
		3	$1243770+x$						

August 1947.

Ti XII

(Na I sequence; 11 electrons) $Z=22$

Ground state $1s^2\,2s^2\,2p^6\,3s\,{}^2S_{1/2}$

$3s\,{}^2S_{1/2}$ **2351530** cm^{-1} I. P. 291.47 volts

Edlén has classified 16 lines in the interval 60 A to 116 A, and extrapolated the absolute value of the ground term from isoelectronic sequence data.

The unit adopted by Edlén, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **100,** 621 (1936). (I P) (T) (C L)

Config.	Desig.	J	Level	Interval
3s	3s ²S	½	0	
3p	3p ²P°	½	208300	8660
		1½	216960	
3d	3d ²D	1½	502370	890
		2½	503260	
4s	4s ²S	½	1133370	
4p	4p ²P°	½	1214330	3340
		1½	1217670	
4d	4d ²D	1½	1321380	460
		2½	1321840	
4f	4f ²F°	2½	1360770	160
		3½	1360930	

Config.	Desig.	J	Level	Interval
5p	5p ²P°	½	1645820	1490
		1½	1647310	
5d	5d ²D	1½	1697530	210
		2½	1697740	
5f	5f ²F°	2½	1717270	140
		3½	1717410	
6f	6f ²F°	2½		
		3½	1911470	
Ti XIII (¹S₀)	Limit	-------	2351530	

June 1947.

Ti XIII

(Ne I sequence; 10 electrons) $Z=22$

Ground state $1s^2\ 2s^2\ 2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ **6360600 cm⁻¹**   I. P. 788.4 volts

Edlén and Tyrén have classified five lines in the interval between 23 A and 26 A, as combinations with the ground term. Their absolute term values are based on extrapolation along the Ne I isoelectronic sequence. Their unit, 10^3 cm⁻¹, has here been changed to cm⁻¹.
As for Ne I, the jl-coupling notation in the general form suggested by Racah is introduced.

REFERENCES

B. Edlén and F. Tyrén, Zeit. Phys. **101**, 210 (1936).   (I P) (T) (C L)
G. Racah, Phys. Rev. **61**, 537 (L) (1942).

Authors	Config.	Desig.	J	Level
2p ¹S₀	2p⁶	2p⁶ ¹S	0	0
3s ³P₁	2p⁵(²P°₁½)3s	3s [1½]°	2	
			1	3709200
3s ¹P₁	2p⁵(²P°½)3s	3s'[½]°	0	
			1	3753600
3d ³P₁	2p⁵(²P°₁½)3d	3d [½]°	0	
			1	4168200
3d ³P₁	"	3d [1½]°	1	4219800
3d ³D₁	2p⁵(²P°½)3d	3d'[1½]°	1	4281600
Ti XIV (²P°₁½)	Limit	-------	6360600	
Ti XIV (²P°½)	Limit	-------	6407500	

April 1947.

VANADIUM

V I

23 electrons $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3\ 4s^2\ {}^4F_{1\frac{1}{2}}$

$a\ {}^4F_{1\frac{1}{2}}$ **54361** cm^{-1} I. P. 6.74 volts

The arc spectrum of vanadium has been studied since 1923. The early contributions of Meggers, Laporte, Landé, Bechert, Sommer, and many others culminated in the extensive analysis of this highly complex spectrum published by Meggers and Russell in 1936. They list 60 doublet terms, 60 quartet terms, and 28 sextet terms from 634 multiplets, and give 2186 classified lines extending from 2082 A to 11911 A. The terms of all three multiplicities are connected by observed intersystem combinations.

The configuration assignments of many of the odd doublet and quartet terms are extremely uncertain and a number of terms are unassigned. No limit assignment has been attempted for the sextet triad $x\ {}^6P°$, $w\ {}^6D°$, and $x\ {}^6F°$, which comes from $3d^4\ 5p$, and for two quartet triads which may arise from $3d^3\ 4s\ 5p$. Rohrlich has suggested that some of the configurations of odd terms from $d^3\ sp$ and $d^4\ p$ should be interchanged.

Zeeman observations by Babcock of more than 900 lines provided the large array of g-values which greatly facilitated the analysis. Much of this material was generously furnished in manuscript form for inclusion in the 1936 paper. A discussion of the g-sums by Russell and Babcock appears in the 1935 reference below.

Six terms, and miscellaneous odd levels were added by the writer in 1939 from additional observations of the spectrum between 1848 A and 2173 A.

REFERENCES

H. N. Russell and H. D. Babcock, *Zeeman Verhandelingen* p. 286 (Martinus Nijhoff, The Hague 1935). (Z E)

W. F. Meggers and H. N. Russell, J. Research Nat. Bur. Std. **17**, 125, RP906 (1936). (I P) (T) (C L) (Z E)

C. E. Moore, Phys. Rev. **55**, 710 (1939). (T) (C L)

W. F. Meggers, J. Opt. Soc. Am. **36**, 431 (1946). (Summary hfs.)

F. Rohrlich, Phys. Rev. **74**, 1393 (1948).

VI

Config.	Desig.	J	Level	Interval	Obs. g
$3d^3\,4s^2$	$a\ ^4F$	1½	0.00		0.40
		2½	137.38	137.38	1.01
		3½	323.42	186.04	1.20
		4½	553.02	229.60	1.28
$3d^4(a\ ^5D)4s$	$a\ ^6D$	½	2112.32		3.29
		1½	2153.20	40.88	1.82
		2½	2220.13	66.93	1.61
		3½	2311.37	91.24	1.53
		4½	2424.89	113.52	1.52
$3d^4(a\ ^5D)4s$	$a\ ^4D$	½	8412.94		0.00
		1½	8476.20	63.26	1.19
		2½	8578.52	102.32	1.35
		3½	8715.72	137.20	1.39
$3d^3\,4s^2$	$a\ ^4P$	½	9544.54		2.59
		1½	9636.96	92.42	1.70
		2½	9824.58	187.62	1.55
$3d^3\,4s^2$	$a\ ^2G$	3½	10892.50		0.88
		4½	11100.65	208.15	1.13
$3d^3\,4s^2$	$a\ ^2P$	1½	13801.53		1.20
		½	13810.90	−9.37	0.64
$3d^3\,4s^2$	$a\ ^2D$	1½	14514.75		0.97
		2½	14548.83	34.08	1.17
$3d^4(a\ ^3H)4s$	$a\ ^4H$	3½	14910.04		0.65
		4½	14949.30	39.26	0.94
		5½	15000.84	51.54	1.10
		6½	15062.94	62.10	1.18
$3d^4(a\ ^3P)4s$	$b\ ^4P$	½	15078.25		2.60
		1½	15270.42	192.17	1.68
		2½	15571.90	301.48	1.54
$3d^3\,4s^2$	$a\ ^2H$	4½	15103.77		0.90
		5½	15264.83	161.06	1.07
$3d^4(b\ ^3F)4s$	$b\ ^4F$	1½	15664.75		0.39
		2½	15688.80	24.05	1.05
		3½	15724.22	35.42	1.22
		4½	15770.72	46.50	1.31
$3d^3\,4s(a\ ^5F)4p$	$z\ ^6G°$	1½	16361.45		0.00
		2½	16449.85	88.40	0.78
		3½	16572.54	122.69	1.10
		4½	16728.75	156.21	1.22
		5½	16917.15	188.40	1.26
		6½	17136.44	219.29	1.43
$3d^4(a\ ^3G)4s$	$a\ ^4G$	2½	17054.87		0.59
		3½	17116.92	62.05	0.96
		4½	17181.98	65.06	1.14
		5½	17242.05	60.07	1.27
$3d^3\,4s(a\ ^5F)4p$	$z\ ^6D°$	½	18085.82		3.20
		1½	18126.27	40.45	1.76
		2½	18198.08	71.81	1.58
		3½	18302.27	104.19	1.56
		4½	18438.07	135.80	1.55
$3d^3\,4s(a\ ^5F)4p$	$z\ ^6F°$	½	18120.12		−0.44
		1½	18174.06	53.94	1.14
		2½	18258.89	84.83	1.28
		3½	18372.46	113.57	1.28
		4½	18513.46	141.00	1.38
		5½	18680.12	166.66	1.42
$3d^4(a\ ^3P)4s$	$b\ ^2P$	½	18805.05		0.67
		1½	19189.28	384.23	1.37
$3d^4(a\ ^3H)4s$	$b\ ^2H$	4½	19023.47		0.91
		5½	19145.13	121.66	1.08
$3d^4(b\ ^3F)4s$	$a\ ^2F$	2½	19026.34		0.86
		3½	19078.15	51.81	1.14
$3d^5$	$a\ ^6S$	2½	20202.49		
$3d^3\,4s(a\ ^3F)4p$	$z\ ^4D°$	½	20606.43		−0.04
		1½	20687.75	81.32	1.21
		2½	20828.48	140.73	1.35
		3½	21032.52	204.04	1.45
$3d^4(a\ ^3D)4s$	$b\ ^4D$	3½	20767.57		1.45
		2½	20789.13	−21.56	1.25
		1½	20812.99	−23.86	1.20
		½	20830.20	−17.21	0.10
$3d^4(a\ ^3G)4s$	$b\ ^2G$	4½	21603.17		1.11
		3½	21646.39	−43.22	0.86
$3d^3\,4s(a\ ^3F)4p$	$z\ ^4G°$	2½	21841.45		0.55
		3½	21963.50	122.05	0.96
		4½	22121.17	157.67	1.16
		5½	22313.99	192.82	1.24
$3d^3\,4s(a\ ^3F)4p$	$z\ ^4F°$	1½	23088.06		0.39?
		2½	23210.56	122.50	0.98?
		3½	23353.09	142.53	1.23
		4½	23519.84	166.75	1.31
$3d^3\,4s(a\ ^3F)4p$	$z\ ^2D°$	1½	23608.80		0.76
		2½	23935.15	326.35	1.32?
$3d^4(a\ ^5D)4p$	$z\ ^6P°$	1½	24648.10		2.34
		2½	24727.85	79.75	1.85
		3½	24838.56	110.71	1.67
$3d^4(a\ ^5D)4p$	$z\ ^4P°$	½	24770.62		2.54
		1½	24915.16	144.54	1.71
		2½	25130.96	215.80	1.59
$3d^4(a\ ^5D)4p$	$y\ ^6F°$	½	24789.36		−0.58
		1½	24830.18	40.82	1.02
		2½	24898.73	68.55	1.23
		3½	24992.88	94.15	1.37
		4½	25111.50	118.62	1.41
		5½	25253.53	142.03	1.41
$3d^4(a\ ^5D)4p$	$y\ ^4F°$	1½	25930 51		0.42
		2½	26004.22	73.71	0.98
		3½	26122.04	117.82	1.15
		4½	26171.96	49.92	1.23
$3d^3\,4s(a\ ^3F)4p$	$z\ ^2G°$	3½	26021.89		0.92
		4½	26344.94	323.05	1.13
$3d^4(a\ ^5D)4p$	$y\ ^4D°$	½	26182.60		−0.06
		1½	26249.48	66.88	1.17
		2½	26352.59	103.11	1.34
		3½	26480.28	127.69	1.39
$3d^4(a\ ^5D)4p$	$y\ ^6D°$	½	26397.36		3.25
		1½	26437.68	40.32	1.86
		2½	26505.88	68.20	1.59
		3½	26604.77	98.89	1.58
		4½	26738.31	133.54	1.50
$3d^3\,4s(a\ ^3F)4p$	$z\ ^2F°$	2½	27187.77		1.01?
		3½	27470.88	283.11	1.01
$3d^3\,4s(a\ ^5P)4p$	$x\ ^6D°$	½	28313.68		3.23
		1½	28368.76	55.08	1.82
		2½	28462.15	93.39	1.58
		3½	28595.64	133.49	1.52
		4½	28768.13	172.49	1.47

V I—Continued

Config.	Desig.	J	Level	Interval	Obs. g
	z ⁴S°	1½	28621.27		
3d³ 4s(a ⁵P)4p	y ⁶P°	1½	29202.80		2.32
		2½	29296.43	93.63	1.76
		3½	29418.17	121.74	1.62
3d³ 4s(c ³P)4p	y ⁴P°	½	30021.57		2.67
		1½	30094.52	72.95	1.74
		2½	30120.78	26.26	1.67
3d³ 4s(b ³G)4p?	y ⁴G°	2½	30635.60		0.53
		3½	30694.34	58.74	0.93
		4½	30771.72	77.38	1.13
		5½	30864.34	92.62	1.21
3d³ 4s(a ⁵P)4p	z ⁶S°	2½	30832.58		
3d³ 4s(b ³G)4p	x ⁴F°	1½	31200.12		0.38
		2½	31228.98	28.86	1.01
		3½	31268.15	39.17	1.21
		4½	31317.50	49.35	1.32
3d³ 4s(a ⁵F)4p	x ⁴G°	2½	31398.09		0.53
		3½	31541.18	143.09	0.95
		4½	31721.73	180.55	1.12
		5½	31937.18	215.45	1.20
	z ²S°	½	31786.19		2.30
	y ²S°	½	31962.30		2.21
	x ⁴D°	½	32348.89		0.08
		1½	32456.45	107.56	1.17
		2½	32660.26	203.81	1.29
		3½	32891.06	230.80	1.35
3d³ 4s(b ³G)4p	z ⁴H°	3½	32692.09		0.68
		4½	32788.22	96.13	0.98
		5½	32897.81	109.59	1.11
		6½	32963.90	66.09	1.21
	z ²P°	½	32724.86		0.73?
		1½	32767.88	43.02	1.22
3d³ 4s(a ⁵F)4p	w ⁴F°	1½	32738.14		0.52
		2½	32846.74	108.60	1.01
		3½	32988.82	142.08	1.18
		4½	33155.30	166.48	1.30
	y ²G°	4½	33306.96		1.03
		3½	33360.31	−53.35	0.91
	y ²F°	3½	33481.45		1.11
		2½	33527.64	−46.19	0.85
	z ²H°	4½	33640.18		0.92
		5½	33695.32	55.14	1.09
3d³ 4s(c ³P)4p	w ⁴D°	½	33966.72		0.09
		1½	33976.02	9.30	0.80
		2½	34065.61	89.59	1.30
		3½	34128.04	62.43	1.35
	1°		34019.12		
	v ⁴F°	1½	34030.04		0.86
		2½	34167.84	137.80	1.32?
		3½	34374.81	206.97	1.21
		4½	34529.81	155.00	1.41
	y ²D°	1½	34428.76		0.73
		2½	34486.80	58.04	1.18

Config.	Desig.	J	Level	Interval	Obs. g
3d³ 4s(a ⁵F)4p	v ⁴D°	½	34477.40		0.00
		1½	34587.21	59.81	1.05
		2½	34619.52	82.31	1.28
		3½	34747.06	127.54	1.35
	u ⁴D°	½	35012.91		
		1½	35092.36	79.45	1.12
		2½	35225.04	132.68	1.32
		3½	35379.11	154.07	1.33
3d⁴(a ³P)4p?	y ⁴S°	1½	36408.23		1.85
	x ²D°	1½	36416.49		0.89
		2½	36700.78	284.29	1.13
3d⁴(b ³F)4p	x ²G°	3½	36461.26		0.85
		4½	36538.58	77.32	1.05
3d³ 4s(b ¹D)4p	y ²P°	½	36477.75		0.74
		1½	36580.46	102.71	1.17
3d⁴(a ³P)4p?	x ⁴P°	2½	36611.81		1.54
		1½	36814.80	−202.99	1.77
		½	36695.49	119.31	2.51
	w ²G°	3½	36628.82		0.65?
		4½	36828.33	199.51	
3d³ 4s(b ³H)4p?	w ⁴G°	2½	36763.41		1.06
		3½	36822.86	59.45	1.17
		4½	36897.88	75.02	1.26
		5½	36938.42	40.54	
	x ²F°	2½	36766.00		0.89
		3½	36925.88	159.88	1.05
3d⁵	e ⁴F	1½	36983.63		
		2½	36989.20	5.57	
		3½	37025.60	36.40	
		4½	37075.64	50.04	
3d⁴(a ⁵D)5s	e ⁶D	½	37116.68		3.08
		1½	37158.36	41.68	1.87
		2½	37227.44	69.08	1.61
		3½	37322.09	94.65	1.64
		4½	37440.74	118.65	1.48
3d⁴(a ³H)4p	v ²G°	3½	37174.68		0.99
		4½	37361.95	187.27	1.05
	y ²H°	4½	37180.90		0.73
		5½	37210.85	29.95	1.08
3d⁴(a ²H)4p	z ⁴I°	4½	37285.03		0.87
		5½	37315.83	30.80	0.96
		6½	37404.25	88.42	1.08
		7½	37518.36	114.11	1.15
3d⁴(b ³F)4p?	w ²F°	2½	37342.66		0.84
		3½	37475.08	132.42	1.08
3d³ 4s(a ⁵F)5s	e ⁶F	½	37374.98		−0.72
		1½	37423.17	48.19	1.05
		2½	37503.14	79.97	1.30
		3½	37614.97	111.83	1.33
		4½	37758.07	143.10	1.43
		5½	37931.41	173.34	1.52
3d⁴(b ³F)4p	w ²D°	1½	37457.50		0.80
		2½	37752.54	295.04	1.18
3d³ 4s(b ³H)4p?	y ⁴H°	3½	37481.36		0.76
		4½	37516.95	35.59	1.05
		5½	37565.88	48.93	1.09
		6½	37626.44	60.56	1.24

Config.	Desig.	J	Level	Interval	Obs. g
$3d^4(b\ ^3F)4p$	$v\ ^4G°$	2½	37498.76		0.60
		3½	37556.00	57.24	1.02
		4½	37644.41	88.41	1.15
		5½	37764.89	120.48	1.22
$3d^4(a\ ^3H)4p?$	$z\ ^2I°$	5½	37530.29		0.94
		6½	37606.32	76.03	1.06
$3d^4(b\ ^3F)4p$	$t\ ^4D°$	½	37757.24		0.01
		1½	37834.98	77.74	1.18
		2½	37959.66	124.68	1.33
		3½	38115.65	155.99	1.35
$3d^4(a\ ^5D)5s$	$e\ ^4D$	½	37940.08		
		1½	38003.93	63.85	
		2½	38106.32	102.39	
		3½	38242.46	136.14	
$3d^4(a\ ^3H)4p$	$x\ ^2H°$	4½	38123.76		0.88
		5½	38220.63	96.87	1.10
$3d^4(a\ ^3H)4p$	$x\ ^4H°$	3½	38245.75		0.67
		4½	38323.87	78.12	0.93
		5½	38404.96	81.09	1.11
		6½	38482.96	78.00	1.22
	$u\ ^2G°$	4½	38529.78		0.99
		3½	38610.94	−81.16	0.88?
$3d^3\ 4s(a\ ^1H)4p?$	$y\ ^2I°$	5½	39008.60		0.92
		6½	39081.10	72.50	1.06
$3d^3\ 4s(a\ ^5F)5s$	$f\ ^4F$	1½	39127.23		0.46?
		2½	39241.34	114.11	1.03
		3½	39398.82	157.48	1.22?
		4½	39597.01	198.19	1.33?
$3d^3\ 4s(a\ ^5P)4p$	$w\ ^4P°$	½	39237.10		2.57
		1½	39248.90	11.80	1.60
		2½	39422.66	173.76	1.52
$3d^4(b\ ^3F)4p$	$u\ ^4F°$	1½	39266.60		0.54
		2½	39300.48	33.88	1.00
		3½	39341.76	41.28	1.21
		4½	39391.02	49.26	1.30
$3d^3\ 4s(c\ ^3P)4p$	$x\ ^4S°$	1½	39847.24		2.00
$3d^4(a\ ^3P)4p$	$s\ ^4D°$	½	39877.62		0.01
		1½	39935.07	57.45	1.10
		2½	39999.89	64.82	1.33
		3½	40125.79	125.90	1.38
$3d^4(a\ ^3P)4p$	$v\ ^2D°$	1½	39884.43		0.92
		2½	40119.26	234.83	1.14
$3d^4(a\ ^3H)4p$	$u\ ^4G°$	2½	39962.17		0.53
		3½	40001.18	39.01	0.99
		4½	40038.95	37.77	1.19
		5½	40063.78	24.83	1.23
	$v\ ^2F°$	2½	40153.51		
		3½	40587.35	433.84	1.01
$3d^3\ 4s(a\ ^1P)4p?$	$u\ ^2D°$	1½	40225.38		0.70
		2½	40325.77	100.39	1.12
$3d^3\ 4s(a\ ^1P)4p?$	$x\ ^2S°$	½	40299.81		
$3d^4(a\ ^3G)4p$	$w\ ^4H°$	3½	40314.83		0.65
		4½	40378.70	63.87	0.92
		5½	40452.38	73.68	1.08
		6½	40535.62	83.24	1.22

Config.	Desig.	J	Level	Interval	Obs. g
	$x\ ^2P°$	½	40328.62		
		1½	40437.42	108.80	1.52
	$w\ ^2P°$	½			
		1½	40693.76		
	$w\ ^2H°$	5½	40919.68		0.96?
		4½	40980.54	−60.86	0.99
$3d^4(a\ ^3G)4p$	$t\ ^4F°$	1½	41389.49		0.42
		2½	41428.93	39.44	0.89?
		3½	41492.29	63.36	1.15
		4½	41599.36	107.07	1.23
$3d^3\ 4s(b\ ^1G)4p?$	$t\ ^2G°$	3½	41436.58		0.90
		4½	41539.14	102.56	1.04
$3d^3\ 4s(a\ ^1H)4p?$	$v\ ^2H°$	4½	41501.41		0.87
		5½	41659.71	158.30	1.05
$3d^4(a\ ^3G)4p$	$t\ ^4G°$	2½	41654.70		0.58
		3½	41758.41	103.71	1.03
		4½	41860.54	102.13	1.20
		5½	41918.24	57.70	1.20
	$v\ ^4P°$	½	41751.78		2.56
		1½	41848.47	96.69	1.62
		2½	42009.93	161.46	1.48
$3d^3\ 4s(a\ ^5P)4p$	$r\ ^4D°$	½	41928.47		0.04
		1½	41999.10	70.63	1.20
		2½	42138.00	138.90	1.33
		3½	42245.61	107.61	1.36
$3d^3\ 4s(b\ ^1D)4p?$	$u\ ^2F°$	2½	41950.35		0.84
		3½	42020.93	70.58	1.11
$3d^4(a\ ^5D)4d$	$e\ ^6G$	1½	42033.84		
		2½	42070.05	36.21	
		3½	42114.17	44.12	1.08
		4½	42177.31	63.14	1.23
		5½	42257.32	80.01	1.32
		6½	42353.42	96.10	1.35
$3d^3\ 4s(b\ ^1G)4p$	$u\ ^2H°$	4½	42079.14		0.85
		5½	42220.69	141.55	1.06
$3d^4(a\ ^5D)4d$	$e\ ^6P$	1½			
		2½			
		3½	42164.74		1.44?
	$2°$	3½	42236.66		
$3d^3\ 4s(a\ ^1P)4p?$	$v\ ^2P°$	1½	42318.42		1.34
		½	42480.62	−162.20	1.14
	$w\ ^2S°$	½	42362.04		1.50?
$3d^4(a\ ^5D)4d$	$f\ ^6F$	½			
		1½			
		2½			
		3½	42363.62		
		4½	42506.32	142.70	
		5½	42577.98	71.66	1.39
$3d^4(a\ ^5D)4d$	^6D	½			
		1½			
		2½			
		3½	42404.89		
		4½	42553.62	148.73	1.61
	$w\ ^6D°$	½			
		1½			
		2½	42480.31		
		3½	42587.41	107.10	
		4½	42725.33	137.92	

Config.	Desig.	J	Level	Interval	Obs. g	Config.	Desig.	J	Level	Interval	Obs. g
$3d^3\,4s(a\,^5\mathrm{P})4p$	$w\ ^4\mathrm{S}^\circ$	$1\tfrac12$	42969. 49		1. 94		$r\ ^4\mathrm{F}^\circ$	$1\tfrac12$	44973. 60	75. 57	0. 58?
								$2\tfrac12$	45049. 17	9. 45	
	$s\ ^4\mathrm{F}^\circ$	$1\tfrac12$	42981. 34	69. 97				$3\tfrac12$	45058. 62	86. 54	0. 97
		$2\tfrac12$	43051. 31	95. 78				$4\tfrac12$	45145. 16		1. 26
		$3\tfrac12$	43147. 09	119. 06			$q\ ^4\mathrm{F}^\circ$	$1\tfrac12$	45066. 56	40. 65	0. 59
		$4\tfrac12$	43266. 15					$2\tfrac12$	45107. 21	50. 51	0. 93
	$q\ ^4\mathrm{D}^\circ$	$\tfrac12$	43249. 44	59. 39				$3\tfrac12$	45157. 72	79. 44	1. 05
		$1\tfrac12$	43308. 83	101. 99				$4\tfrac12$	45237. 16		1. 22
		$2\tfrac12$	43410. 82	144. 30			$u\ ^2\mathrm{P}^\circ$	$\tfrac12$			
		$3\tfrac12$	43555. 12		1. 46			$1\tfrac12$	45159. 15		1. 66?
	$u\ ^4\mathrm{P}^\circ$	$\tfrac12$	43443. 33	60. 66		$3d^3\,4s(a\,^1\mathrm{H})4p?$	$r\ ^2\mathrm{G}^\circ$	$3\tfrac12$	45175. 92	185. 50	0. 98
		$1\tfrac12$	43503. 99	81. 60				$4\tfrac12$	45361. 42		1. 14
		$2\tfrac12$	43585. 59				$2a^\circ$	$5\tfrac12$	45353. 69		
$3d^3\,4s(a\,^5\mathrm{F})4d$	$e\ ^6\mathrm{H}$	$2\tfrac12$	43649. 40	57. 42	0. 38	$3d^3\,4s(a\,^5\mathrm{F})4d$	$g\ ^6\mathrm{F}$	$\tfrac12$			
		$3\tfrac12$	43706. 82	80. 78	0. 88			$1\tfrac12$	45638. 54	61. 71	
		$4\tfrac12$	43787. 60	106. 55	1. 11			$2\tfrac12$	45700. 25	43. 37	
		$5\tfrac12$	43894. 15	134. 18	1. 18			$3\tfrac12$	45743. 62	69. 63	1. 26
		$6\tfrac12$	44028. 33	161. 62	1. 30			$4\tfrac12$	45813. 25	221. 33	
		$7\tfrac12$	44189. 95		1. 38			$5\tfrac12$	46034. 58		
	$x\ ^6\mathrm{F}^\circ$	$\tfrac12$	43707. 97?	137. 83		$3d^4(a\,^3\mathrm{D})4p$	$p\ ^4\mathrm{F}^\circ$	$1\tfrac12$	45648. 86	39. 55	0. 60
		$1\tfrac12$	43845. 80?	113. 44				$2\tfrac12$	45688. 41	71. 62	
		$2\tfrac12$	43959. 24?	67. 05				$3\tfrac12$	45760. 03	131. 52	1. 02
		$3\tfrac12$	44026. 29?	176. 22				$4\tfrac12$	45891. 55		1. 32
		$4\tfrac12$	} 44202. 51?								
		$5\tfrac12$					$t\ ^2\mathrm{P}^\circ$	$1\tfrac12$	45654. 50	−292. 16	1. 24?
$3d^3\,4s(a\,^5\mathrm{F})4d$	$f\ ^6\mathrm{G}$	$1\tfrac12$	43818. 02	29. 14	0. 38?			$\tfrac12$	45946. 66		
		$2\tfrac12$	43847. 16	64. 77	0. 78	$3d^4(a\,^3\mathrm{D})4p$	$o\ ^4\mathrm{D}^\circ$	$\tfrac12$	45702. 14	60. 10	
		$3\tfrac12$	43911. 93	93. 21	1. 12			$1\tfrac12$	45762. 24	75. 82	0. 96?
		$4\tfrac12$	44005. 14	134. 55	1. 26			$2\tfrac12$	45838. 06	99. 01	
		$5\tfrac12$	44139. 69	187. 35	1. 34			$3\tfrac12$	45937. 07		1. 45
		$6\tfrac12$	44327. 04		1. 35		$r\ ^4\mathrm{G}^\circ$	$2\tfrac12$	46052. 79	86. 27	0. 56
$3d^2\,4s(b\,^1\mathrm{G})4p$	$t\ ^2\mathrm{F}^\circ$	$3\tfrac12$	43873. 79	−1. 46	1. 04?			$3\tfrac12$	46139. 06	104. 58	0. 96
		$2\tfrac12$	43875. 25		0. 86			$4\tfrac12$	46243. 64	119. 78	1. 15
$3d^2\,4s(a\,^3\mathrm{F})5s$	$e\ ^2\mathrm{F}$	$2\tfrac12$	43918. 58	147. 47	0. 89			$5\tfrac12$	46363. 42		1. 19
		$3\tfrac12$	44066. 05		1. 18		4°	$1\tfrac12$	} 46322. 39:		
	$x\ ^6\mathrm{P}^\circ$	$1\tfrac12$						$2\tfrac12$			
		$2\tfrac12$					5°	$2\tfrac12$	46500. 64		
		$3\tfrac12$	43988. 00?				6°	$1\tfrac12$	46707. 18		
	$s\ ^4\mathrm{G}^\circ$	$2\tfrac12$	43999. 68	43. 68			$t\ ^4\mathrm{P}^\circ$	$\tfrac12$	46851. 10	11. 63	
		$3\tfrac12$	44043. 36	61. 19	0. 98			$1\tfrac12$	46862. 73	5. 37	
		$4\tfrac12$	44104. 55	73. 90	1. 26			$2\tfrac12$	46868. 10		
		$5\tfrac12$	44178. 45		1. 34	$3d^3\,4s(b\,^3\mathrm{G})4p$	$s\ ^2\mathrm{F}^\circ$	$2\tfrac12$	46996. 84	146. 40	
$3d^4(a\,^3\mathrm{G})4p$	$t\ ^2\mathrm{H}^\circ$	$4\tfrac12$	44145. 77	38. 25	0. 90			$3\tfrac12$	47143. 24		1. 02
		$5\tfrac12$	44184. 02		1. 06?		7°	$3\tfrac12$	47348. 14		
$3d^3\,4s(a\,^5\mathrm{F})4d$	$f\ ^6\mathrm{P}$	$1\tfrac12$	44443. 67	88. 93			3°	$1\tfrac12$	47423. 18		
		$2\tfrac12$	44532. 60	157. 87		$3d^3\,4s(b\,^3\mathrm{G})4p$	$s\ ^2\mathrm{H}^\circ$	$4\tfrac12$	47611. 77	89. 78	1. 01?
		$3\tfrac12$	44690. 47					$5\tfrac12$	47701. 55		0. 94
$3d^4(a\,^3\mathrm{G})4p$	$s\ ^2\mathrm{G}^\circ$	$4\tfrac12$	44463. 28	−32. 15	1. 09		8°	$3\tfrac12$	47615. 56		
		$3\tfrac12$	44495. 43		0. 91		9°	$1\tfrac12$	} 47682. 68		
	$p\ ^4\mathrm{D}^\circ$	$\tfrac12$	44514. 34	39. 91				$2\tfrac12$			
		$1\tfrac12$	44554. 25	62. 43	1. 22		$q\ ^4\mathrm{G}^\circ$	$2\tfrac12$	47690. 5	132. 7	
		$2\tfrac12$	44616. 68	84. 20	1. 37?			$3\tfrac12$	47823. 24	190. 94	
		$3\tfrac12$	44700. 88		1. 32?			$4\tfrac12$	48014. 18	176. 86	
$3d^2\,4s(a\,^5\mathrm{F})4d$	$g\ ^6\mathrm{D}$	$\tfrac12$						$5\tfrac12$	48191. 04		
		$1\tfrac12$	44844. 83	76. 25							
		$2\tfrac12$	44921. 08	135. 53	1. 55?						
		$3\tfrac12$	45056. 61	101. 13							
		$4\tfrac12$	45157. 74								

Config.	Desig.	J	Level	Interval	Obs. g
	o ⁴F°	1½	47801. 6	114. 3	
		2½	47915. 9	223. 5	
		3½	48139. 4	189. 4	
		4½	48328. 8		
	10°	2½	47809. 20		
	11°	2½	47925. 49:		
3d³ 4s(b ³G)4p	q ²G°	3½	47959. 82	197. 75	0. 89
		4½	48157. 57		1. 08
	12°	{ 2½ 3½ }	48001. 8:		
	13°	3½	48023. 68		
	14°	3½	48047. 63		
	15°	2½	48070. 91		
	16°	{ 2½ 3½ }	48201. 79		
	17°	3½?	48289. 8		
3d⁴(a ³P)4p?	v ²S°	½	48844. 67		2. 03
	18°	2½	48881. 48		
	19°	2½	48964. 99		
	20°	1½	49000. 82		
	n ⁴D°	½	49189. 74	94. 03	
		1½	49283. 77	156. 54	
		2½	49440. 31	143. 78	
		3½	49584. 09		
	21°	2½	49302. 61		
	22°	{ 3½ 4½ }	49341. 90:		
3d³ 4s(b ³D)4s	t ²D°	2½	49689. 01	−33. 87	1. 25
		1½	49722. 88		
3d³ 4s(a ⁵F)5d	f ⁶H	2½	49717. 57	79. 61	
		3½	49797. 18	77. 94	
		4½	49875. 12	108. 04	
		5½	49983. 16	181. 10	
		6½	50164. 26	137. 37	
		7½	50301. 63		
3d³ 4s(a ⁵F)5d	g ⁶G	1½			
		2½			
		3½	49789. 17	143. 20	
		4½	49932. 37	182. 22	
		5½	50114. 59	94. 46	
		6½	50209. 05		
3d³ 4s(b ³H)4p	x ²I°	5½	49977. 90	142. 79	0. 91
		6½	50120. 69		1. 06
	23°	3½?	50090. 28		

Config.	Desig.	J	Level	Interval	Obs. g
	24°	2½	50130. 6		
	25°	3½?	50154. 35		
	26°	{ 2½ 3½ }	50333. 59		
	27°	1½	50355. 89		
	r ²F°	2½	50404. 14	135. 13	
		3½	50539. 27		
	28°	{ 2½ 3½ }	50438. 35		
	p ⁴G°	2½	50452. 6:	127. 0	
		3½	50579. 6	162. 8	
		4½	50742. 4	191. 2	
		5½	50933. 58:		
	29°	3½	50529. 67		
3d³ 4p²	h ⁶G	1½	50584. 27	70. 45	
		2½	50654. 72	97. 11	
		3½	50751. 83	124. 17	
		4½	50876. 00	150. 30	
		5½	51026. 30	174. 82	
		6½	51201. 12		
	30°	3½	50595. 73		
	n ⁴F°	1½	50909. 7	111. 5	
		2½	51021. 2	153. 3	
		3½	51174. 50	192. 1	
		4½	51366. 6		
	m ⁴D°	½	50976. 5:	91. 2	
		1½	51067. 7	144. 5	
		2½	51212. 2:	185. 9	
		3½	51398. 1:		
	31°	{ 1½ 2½ }	51194. 2		
	32°	1½	51830. 69		
	33°	{ 2½ 3½ }	52008. 09		
3d³ 4s(b ³H)4p?	p ²G°	3½	52774. 08	173. 90	
		4½	52947. 98		
3d³ 4s(b ³H)4p?	r ²H°	4½	54081. 51	169. 75	
		5½	54251. 26		
V II (a ⁵D₀)	Limit	-----	54361		
	34°	2½	55202. 44		
	35°	{ 1½ 2½ }	55877. 82:		
	s ²P°	1½	57561. 36?	−182. 76	
		½	57744. 12?		

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Observed Terms				
$3d^3\,4s^2$	$a\ ^4P$ $a\ ^2P$	$a\ ^2D$	$a\ ^4F$	$a\ ^2G$	$a\ ^2H$
$3d^5$	$a\ ^6S$		$e\ ^4F$		
$3d^3\,4p^2$			$h\ ^6G$		

	$ns\ (n\geq 4)$
$3d^4(a\ ^5D)nx$	$a,e\ ^6D$; $a,e\ ^4D$
$3d^3\,4s(a\ ^5F)nx$	$e\ ^6F$; $f\ ^4F$
$3d^3\,4s(a\ ^3F)nx$	$e\ ^2F$
$3d^4(a\ ^3P)nx$	$b\ ^4P$; $b\ ^2P$
$3d^4(a\ ^3H)nx$	$a\ ^4H$; $b\ ^2H$
$3d^4(b\ ^3F)nx$	$b\ ^4F$; $a\ ^2F$
$3d^4(a\ ^3G)nx$	$a\ ^4G$; $b\ ^2G$
$3d^4(a\ ^3D)nx$	$b\ ^4D$

	$np\ (n\geq 4)$	$nd\ (n\geq 4)$
$3d^4(a\ ^5D)nx$	$z\ ^6P^\circ\quad y\ ^6D^\circ\quad y\ ^6F^\circ$ $z\ ^4P^\circ\quad y\ ^4D^\circ\quad y\ ^4F^\circ$	$e\ ^6P\quad f\ ^6D\quad f\ ^6F\quad e\ ^6G$
$3d^3\,4s(a\ ^5F)nx$	$z\ ^6D^\circ\quad z\ ^6F^\circ\quad z\ ^6G^\circ$ $v\ ^4D^\circ\quad w\ ^4F^\circ\quad x\ ^4G^\circ$	$f\ ^6P\quad g\ ^6D\quad g\ ^6F\quad f,g\ ^6G\quad e,f\ ^6H$
$3d^3\,4s(a\ ^3F)nx$	$z\ ^4D^\circ\quad z\ ^4F^\circ\quad z\ ^4G^\circ$ $z\ ^2D^\circ\quad z\ ^2F^\circ\quad z\ ^2G^\circ$	
$3d^4(a\ ^3P)nx$	$y\ ^4S^\circ?\quad x\ ^4P^\circ?\quad s\ ^4D^\circ$ $v\ ^2S^\circ?\qquad\qquad v\ ^2D^\circ$	
$3d^4(a\ ^3H)nx$	$u\ ^4G^\circ\quad x\ ^4H^\circ\quad z\ ^4I^\circ$ $v\ ^2G^\circ\quad x\ ^2H^\circ\quad z\ ^2I^\circ?$	
$3d^4(b\ ^3F)nx$	$t\ ^4D^\circ\quad u\ ^4F^\circ\quad v\ ^4G^\circ$ $w\ ^2D^\circ\quad w\ ^2F^\circ?\quad x\ ^2G^\circ$	
$3d^3\,4s(a\ ^5P)nx$	$z\ ^6S^\circ\quad y\ ^6P^\circ\quad x\ ^6D^\circ$ $w\ ^4S^\circ\quad w\ ^4P^\circ\quad r\ ^4D^\circ$	
$3d^4(a\ ^3G)nx$	$t\ ^4F^\circ\quad t\ ^4G^\circ\quad w\ ^4H^\circ$ $s\ ^2G^\circ\quad t\ ^2H^\circ$	
$3d^3\,4s(b\ ^3G)nx$	$x\ ^4F^\circ\quad y\ ^4G^\circ?\quad z\ ^4H^\circ$ $s\ ^2F^\circ\quad q\ ^2G^\circ\quad s\ ^2H^\circ$	
$3d^4(a\ ^3D)nx$	$o\ ^4D^\circ\quad p\ ^4F^\circ$	
$3d^3\,4s(b\ ^1G)nx$	$t\ ^2F^\circ\quad t\ ^2G^\circ?\quad u\ ^2H^\circ$	
$3d^3\,4s(c\ ^3P)nx$	$x\ ^4S^\circ\quad y\ ^4P^\circ\quad w\ ^4D^\circ$	
$3d^3\,4s(b\ ^3H)nx$	$w\ ^4G^\circ?\quad y\ ^4H^\circ?$ $p\ ^2G^\circ?\quad r\ ^2H^\circ?\quad x\ ^2I^\circ$	
$3d^3\,4s(b\ ^3D)nx$	$t\ ^2D^\circ$	
$3d^3\,4s(a\ ^1P)nx$	$x\ ^2S^\circ?\quad v\ ^2P^\circ?\quad u\ ^2D^\circ?$	
$3d^3\,4s(a\ ^1H)nx$	$r\ ^2G^\circ?\quad v\ ^2H^\circ?\quad y\ ^2I^\circ?$	
$3d^3\,4s(b\ ^1D)nx$	$y\ ^2P^\circ\qquad u\ ^2F^\circ?$	

*For predicted terms in the spectra of the VI isoelectronic sequence, see Introduction.

V II

(Ti I sequence; 22 electrons) $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4\ {}^5D_0$

$a\ {}^5D_0\ 114600\ cm^{-1}$ I. P. 14.2 volts

The analysis is from the paper by Meggers and the writer, who published 89 terms and 1456 classified lines in the region from 1313 A to 7015 A. The terms of the three multiplicities are connected by observed intersystem combinations.

The g-values were calculated from unpublished data kindly furnished by Babcock and given in the 1940 reference below.

This is the first spectrum in which all theoretical terms (except the highest singlet, ${}^1S$), arising from the electron configuration d^4 have been established.

Many has discussed the configuration assignments and suggests from theoretical calculations that the term $c\ {}^1D$ at 44658 cm^{-1} be assigned to $3d^3\ 4s$. The two other terms which he criticizes, $b\ {}^3P$ and $c\ {}^3P$, were published in 1940 with precisely the limits he suggests.

Although intensively sought, series have not been found, probably because this spectrum has been observed only with condensed sparks at atmospheric pressure. The limit, entered in brackets in the table, was estimated by Russell from isoelectronic sequence data.

When the analysis of V III has been extended, the prefixes b, c, assigned by the writer to the limits may be changed. The limits here called $a\ {}^2F$, $b\ {}^2G$, and $c\ {}^2D$ have not yet been observed in V III.

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V II   V II

Config.	Desig.	J	Level	Interval	Obs. g	Config.	Desig.	J	Level	Interval	Obs. g
$3d^4$	$a\ {}^5D$	0	0. 00			$3d^4$	$a\ {}^3H$	4	12545. 15		0. 83:
		1	36. 05	36. 05				5	12621. 57	76. 42	1. 02
		2	106. 63	70. 58				6	12706. 15	84. 58	1. 27:
		3	208. 89	102. 26		$3d^4$	$b\ {}^3F$	2	13490. 84		0. 59
		4	339. 21	130. 32				3	13542. 68	51. 84	1. 06
$3d^3(a\ {}^4F)4s$	$a\ {}^5F$	1	2604. 82					4	13609. 00	66. 32	1. 19
		2	2687. 01	82. 19	0. 97	$3d^3(a\ {}^4P)4s$	$a\ {}^5P$	1	13511. 71		2. 39
		3	2808. 76	121. 75	1. 20			2	13594. 73	83. 02	1. 78
		4	2968. 22	159. 46	1. 30:			3	13741. 61	146. 88	1. 62
		5	3162. 80	194. 58	1. 28:						
$3d^3(a\ {}^4F)4s$	$a\ {}^3F$	2	8640. 21		0. 65	$3d^4$	$a\ {}^3G$	3	14461. 73		0. 74
		3	8841. 97	201. 76	1. 04			4	14556. 09	94. 36	1. 00
		4	9097. 81	255. 84	1. 22			5	14655. 63	99. 54	1. 17
$3d^4$	$a\ {}^3P$	0	11295. 51			$3d^3(a\ {}^2G)4s$	$b\ {}^3G$	3	16340. 97		0. 76
		1	11514. 76	219. 25	1. 48			4	16421. 51	80. 54	1. 03
		2	11908. 27	393. 51	1. 49			5	16533. 00	111. 49	1. 16

Config.	Desig.	J	Level	Interval	Obs. g
3d⁴	a ¹G	4	17910.98		0.95
3d⁴	a ³D	1	18269.49	24.38	0.49
		2	18293.87	60.02	1.13
		3	18353.89		1.30
3d³(a ²G)4s	b ¹G	4	19112.93		0.98
3d³(a ²P)4s	b ³P	2	19132.69	−33.50	1.38
		1	19166.19	4.92	1.40
		0	19161.27		
3d⁴	a ¹I	6	19191.50		0.96:
3d⁴	a ¹S	0	19902.60		
3d³(a ⁴P)4s	c ³P	0	20156.64	−67.08	1.35
		1	20089.56	253.44	1.36
		2	20343.00		
3d³(a ²H)4s	b ³H	4	20242.32	37.87	0.82
		5	20280.19	83.03	1.01
		6	20363.22		1.14
3d³(a ²D)4s	b ³D	1	20522.14	94.91	0.58
		2	20617.05	5.94	1.25
		3	20622.99		1.26
3d⁴	a ¹D	2	20980.92		1.02
3d³(a ²P)4s	a ¹P	1	22273.54		0.97
3d³(a ²H)4s	a ¹H	5	23391.09		1.04
3d³(a ²D)4s	b ¹D	2	25191.08		0.99
3d⁴	a ¹F	3	26839.82		0.97
3d⁴	c ³F	2	30267.46	38.94	0.67
		3	30306.40	12.23	1.06
		4	30318.63		1.25
3d³(a ²F)4s	d ³F	4	30613.97	−27.74	1.23
		3	30641.71	−31.43	1.05
		2	30673.14		0.67
3d⁴	d ³P	2	32040.76	−258.48	1.38
		1	32299.24	−120.80	1.48
		0	32420.04		
3d³(a ²F)4s	b ¹F	3	34228.79		1.00
3d³(a ⁴F)4p	z ⁵G°	2	34592.72	153.00	0.31
		3	34745.72	200.83	0.93
		4	34946.55	246.58	1.14
		5	35193.13	290.26	1.16
		6	35483.39		
3d⁴	c ¹G	4	36425.07		0.96
3d³(a ⁴F)4p	z ⁵F°	1	36489.34	184.17	0.35
		2	36673.51	245.72	1.08
		3	36919.23	231.34	1.24
		4	37150.57	201.82	
		5	37352.39		1.40:

Config.	Desig.	J	Level	Interval	Obs. g
3d³(a ⁴F)4p	z ³D°	1	36954.58	86.53	0.24
		2	37041.11	163.90	1.08
		3	37205.01		1.32
3d³(a ⁴F)4p	z ⁵D°	0	37201.41	58.01	
		1	37259.42	109.59	1.39
		2	37369.01	151.60	1.39
		3	37520.61	10.48	1.47
		4	37531.09		1.44
3d³(a ⁴F)4p	z ³G°	3	39234.05	169.72	0.84
		4	39403.77	209.20	1.03
		5	39612.97		1.19
3d³(a ⁴F)4p	z ³F°	2	40001.66	193.86	0.65
		3	40195.52	234.58	1.02
		4	40430.10		1.22
3d³(c ²D)4s	c ³D	3	44098.46	−60.97	1.27:
		2	44159.43	−41.54	1.14:
		1	44200.97:?		0.50:
3d⁴	c ¹D	2	44657.99		
3d³(a ⁴P)4p	z ³P°	0	46586.43	104.00	
		1	46690.43	49.55	1.44
		2	46739.98		1.48
3d³(a ⁴P)4p	z ⁵P°	1	46754.59	125.35	2.28
		2	46879.94	171.95	1.65
		3	47051.89		1.58
3d³(a ⁴P)4p	y ⁵D°	0	47027.88	80.10	
		1	47107.98	−6.10	1.43
		2	47101.88	79.29	1.47
		3	47181.17	238.93	1.48:
		4	47420.10		2.28
3d³(a ²G)4p	z ³H°	4	47056.32	240.76	0.78
		5	47297.08	310.71	1.01
		6	47607.79		1.13
3d³(a ²P)4p	z ¹S°	0	48258.28		
3d³(a ²G)4p	y ³G°	3	48579.96	150.80	0.67
		4	48730.76	122.28	1.02
		5	48853.04		1.22
3d³(a ²G)4p	y ³F°	2	49201.66	9.12	0.63
		3	49210.78	57.83	0.99
		4	49268.61		1.18
3d³(a ²G)4p	z ¹F°	3	49568.45		0.97
3d³(a ²G)4p	z ¹H°	5	49593.41		0.95
3d³(a ²G)4p	z ¹G°	4	49723.68		0.96
3d³(a ⁴P)4p	z ⁵S°	2	49731.32		
3d³(a ²P)4p	z ¹D°	2	49898.22		0.93
3d³(a ⁴P)4p	y ³D°	1	50473.76	301.71	0.49
		2	50775.47	310.30	1.11
		3	51085.77		1.27
3d³(a ²P)4p	y ³P°	0	50662.36	76.46	
		1	50738.82	384.49	1.39
		2	51123.31		1.51

V II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3d^3(a\,^2H)4p$	$y\,^3H°$	4	52082.88	70.67	0.70
		5	52153.55	99.15	0.98
		6	52252.70		1.04:
$3d^3(a\,^2P)4p$	$z\,^3S°$	1	52181.18		1.85
$3d^3(a\,^2D)4p$	$x\,^3F°$	2	52245.68	146.26	0.68
		3	52391.94	265.57	1.07
		4	52657.51		1.18:
$3d^3(a\,^2P)4p$	$x\,^3D°$	1	52604.11	95.92	0.63
		2	52700.03	67.33	1.10
		3	52767.36		1.26
$3d^3(a\,^2P)4p$	$z\,^1P°$	1	52803.75		0.92
$3d^3(a\,^2H)4p$	$z\,^3I°$	5	52877.99	198.83	0.84:
		6	53076.82	242.70	0.98
		7	53319.52		1.11:
$3d^3(a\,^2D)4p$	$w\,^3D°$	1	53751.46	117.17	0.49:
		2	53868.63	58.56	1.10
		3	53927.19		1.37
$3d^3(a\,^2H)4p$	$y\,^1G°$	4	54144.20		1.00
$3d^3(a\,^2D)4p$	$x\,^3P°$	2	54715.63	−2.22	
		1	54717.85	−95.60	
		0	54813.45		
$3d^3(a\,^2D)4p$	$y\,^1F°$	3	55142.01		0.94
$3d^3(a\,^2H)4p$	$x\,^3G°$	5	55206.87	−97.47	1.15
		4	55304.34	−45.29	1.02
		3	55349.63		0.82
$3d^3(a\,^2H)4p$	$z\,^1I°$	6	55403.38		1.01:
$3d^3(a\,^2H)4p$	$y\,^1H°$	5	55499.38		1.03:
$3d^3(a\,^4P)4p$	$y\,^3S°$	1	55663.27		1.92
$3d^3(a\,^2D)4p$	$y\,^1P°$	1	56171.49		1.05:
$3d^3(a\,^2D)4p$	$y\,^1D°$	2	57342.59		0.98
$3d^3(a\,^2F)4p$	$w\,^3F°$	2	62085.02	48.37	0.58:
		3	62133.39	42.85	1.00
		4	62176.24		1.36:
	$1°$	4	62761.9		
$3d^2\,4s(b\,^4F)4p$	$y\,^5F°$	1	63548.5:	108.7	
		2	63657.2	159.7	
		3	63816.9	209.7	
		4	64026.6	260.5	
		5	64287.1		
$3d^3(a\,^2F)4p$	$w\,^3G°$	3	64057.39	73.45	0.72:
		4	64130.84	98.26	1.02
		5	64229.10		
$3d^2(a\,^2F)4p$	$x\,^1D°$	2	64586.23		1.03:
$3d^3(a\,^2F)4p$	$v\,^3D°$	3	64603.53	−200.60	1.22:
		2	64804.13	−126.63	1.02:
		1	64930.76		0.46:
$3d^2\,4s(b\,^4F)4p$	$x\,^5D°$	0	65783.4	32.8	
		1	65816.2	69.1	
		2	65885.3	111.4	
		3	65996.7	161.9	
		4	66158.6		

V II—Continued

Config.	Desig.	J	Level	Interval	Obs. g
$3d^3(a\,^2F)4p$	$x\,^1G°$	4	65790.28		0.94
$3d^2\,4s(b\,^2F)4p$	$y\,^5G°$	2	66228.4:	438.9	
		3	66667.3:	295.4	
		4	66962.7:	393.3	
		5	67356.0:	439.7	
		6	67795.7:?		
$3d^3(a\,^2F)4p$	$x\,^1F°$	3	66303.88		0.95
$3d^2\,4s(b\,^4F)4p$	$v\,^3F°$	2	67737.8	167.3	
		3	67905.1	242.1	
		4	68147.2		
$3d^2\,4s(b\,^4F)4p$	$u\,^3D°$	1	68759.4	38.3	
		2	68797.7	147.3	
		3	68945.0		
$3d^2\,4s(b\,^4F)4p$	$v\,^3G°$	3	69644.2	267.9	
		4	69912.1	315.7	
		5	70227.8		
$3d^2\,4s(b\,^2G)4p$	$x\,^1H°$	5	70936.4		
$3d^2\,4s(b\,^2G)4p$	$w\,^1G°$	4	72292.2:		
$3d^3(a\,^4F)4d$	$e\,^5H$	3	72447.96:	102.75	
		4	72550.71	129.49	
		5	72680.20:	156.80	
		6	72837.00:	183.35	
		7	73020.35:		
$3d^3(a\,^4F)4d$	$e\,^5P$	1	72517.84:	156.44	
		2	72674.28	233.89	
		3	72908.17		
$3d^3(a\,^4F)4d$	$e\,^5D$	0			
		1			
		2	72682.06:?	107.17	
		3	72789.23:?	161.77	
		4	72951.00:		
$3d^3(a\,^4F)4d$	$e\,^5G$	2	73026.76	118.92	
		3	73145.68	133.24	
		4	73278.92	137.71	
		5	73416.63	82.30	
		6	73498.93:		
$3d^3(a\,^4F)4d$	$e\,^5F$	1			
		2			
		3			
		4	73222.72:	71.10	
		5	73293.82:?		
$3d^2\,4s(b\,^2G)4p$	$w\,^1F°$	3	74664.5		
$3d^3(c\,^2D)4p?$	$t\,^3D°$	1	75715.45:?	42.84	0.50:
		2	75758.29	89.84	1.14:
		3	75848.13		1.27:
	$u\,^3F°$	2	76220.4	165.4	
		3	76385.8	257.7	
		4	76643.5		
	$2°$	3	76405.4		
	$w\,^1D°$	2	78791.3:		
	$3°$	3	79040.4		
V III $(a\,^4F_{1\frac{1}{2}})$	Limit	----	[114600]		

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Observed Terms				
$3d^4$	$a\,^5D$				
	$a\,^3P$ $a\,^3D$ $b\,^3F$ $a\,^3G$ $a\,^3H$				
	$d\,^3P$ $c\,^3F$				
	$a\,^1S$ $a\,^1D$ $a\,^1F$ $a\,^1G$ $a\,^1I$				
	$c\,^1D$ $c\,^1G$				

	$ns\ (n\geq4)$			$np\ (n\geq4)$					
$3d^3(a\,^4F)nx$	$a\,^5F$			$z\,^5D^\circ$	$z\,^5F^\circ$	$z\,^5G^\circ$			
	$a\,^3F$			$z\,^3D^\circ$	$z\,^3F^\circ$	$z\,^3G^\circ$			
$3d^3(a\,^2P)nx$	$b\,^3P$			$z\,^3S^\circ$	$y\,^3P^\circ$	$x\,^3D^\circ$			
	$a\,^1P$			$z\,^1S^\circ$	$z\,^1P^\circ$	$z\,^1D^\circ$			
$3d^3(a\,^4P)nx$	$a\,^5P$			$z\,^5S^\circ$	$z\,^5P^\circ$	$y\,^5D^\circ$			
	$c\,^3P$			$y\,^3S^\circ$	$z\,^3P^\circ$	$y\,^3D^\circ$			
$3d^3(a\,^2G)nx$			$b\,^3G$				$y\,^3F^\circ$	$y\,^3G^\circ$	$z\,^3H^\circ$
			$b\,^1G$				$z\,^1F^\circ$	$z\,^1G^\circ$	$z\,^1H^\circ$
$3d^3(a\,^2D)nx$		$b\,^3D$		$x\,^3P^\circ$	$w\,^3D^\circ$	$x\,^3F^\circ$			
		$b\,^1D$		$y\,^1P^\circ$	$y\,^1D^\circ$	$y\,^1F^\circ$			
$3d^3(a\,^2H)nx$			$b\,^3H$				$x\,^3G^\circ$	$y\,^3H^\circ$	$z\,^3I^\circ$
			$a\,^1H$				$y\,^1G^\circ$	$y\,^1H^\circ$	$z\,^1I^\circ$
$3d^3(a\,^2F)nx$		$d\,^3F$			$v\,^3D^\circ$	$w\,^3F^\circ$	$w\,^3G^\circ$		
		$b\,^1F$			$x\,^1D^\circ$	$x\,^1F^\circ$	$x\,^1G^\circ$		
$3d^2\,4s(b\,^4F)nx$					$x\,^5D^\circ$	$y\,^5F^\circ$	$y\,^5G^\circ$		
					$u\,^3D^\circ$	$v\,^3F^\circ$	$v\,^3G^\circ$		
$3d^2\,4s(b\,^2G)nx$							$w\,^1F^\circ$	$w\,^1G^\circ$	$x\,^1H^\circ$
$3d^3(c\,^2D)nx$	$c\,^3D$			$t\,^3D^\circ$					

	$nd\ (n\geq4)$				
$3d^3(a\,^4F)nx$	$e\,^5P$ $e\,^5D$ $e\,^5F$ $e\,^5G$ $e\,^5H$				

*A chart of predicted terms in the spectra of the Ti I isoelectronic sequence is given in the Introduction. Owing to the differences in binding energy of the $3d$ and $4s$ electrons the arrangement of the charts of predicted and observed terms is different for V II.

V III

(Sc I sequence; 21 electrons) $Z=23$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^3\ ^4F_{1\frac12}$

$a\ ^4F_{1\frac12}$ 240000 cm^{-1} I.P. 29.7 volts

    The analysis is by White, who has classified 120 lines in the interval between 1117 A and 2595 A. The limit (entered in brackets in the table) is derived from his extrapolation of isoelectronic sequence data.

    The doublet and quartet terms are connected by observed intersystem combinations.

    The reality of the term $a\ ^2P$ is questioned in the paper by Many.

REFERENCES

H. E. White, Phys. Rev. **33**, 672 (1929). (I P) (T) (C L)

A. Many, Phys. Rev. **70**, 513 (1946).

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3d^3$	$a\ ^4F$	1½	0	145	$3d^2(a\ ^3F)4p$	$z\ ^4F°$	1½	86716	221
		2½	145	194			2½	86937	281
		3½	339	244			3½	87218	326
		4½	583				4½	87544	
$3d^3$	$a\ ^2P$	½	11207	180	$3d^2(a\ ^3F)4p$	$z\ ^2F°$	2½	87881	448
		1½	11387				3½	88329	
$3d^3$	$a\ ^4P$	½	11513	77	$3d^2(a\ ^3F)4p$	$z\ ^2D°$	1½	88560	386
		1½	11590	181			2½	88946	
		2½	11771		$3d^2(a\ ^3F)4p$	$z\ ^4D°$	½	89004	187
$3d^3$	$a\ ^2G$	3½	11966	221			1½	89191	267
		4½	12187				2½	89458	−40
$3d^3$	$a\ ^2D$	1½	16229	147			3½	89418	
		2½	16376		$3d^2(a\ ^3F)4p$	$z\ ^2G°$	3½	91712	343
$3d^3$	$a\ ^2H$	4½	16822	155			4½	92055	
		5½	16977		$3d^2(a\ ^3F)4d$	$e\ ^4H$	3½	141269	217
$3d^2(a\ ^3F)4s$	$b\ ^4F$	1½	43941	167			4½	141486	247
		2½	44108	236			5½	141733	258
		3½	44344	301			6½	141991	
		4½	44645						
$3d^2(a\ ^3F)4s$	$b\ ^2F$	2½	49329	478	V IV ($a\ ^3F_2$)	*Limit*	---	[240000]	
		3½	49807						
$3d^2(a\ ^3F)4p$	$z\ ^4G°$	2½	85523	351					
		3½	85874	431					
		4½	86305	503					
		5½	86808						

June 1948.

V III Observed Terms*

Config. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6+$	Observed Terms		
$3d^3$	$\begin{cases} a\ ^4P \quad\quad a\ ^4F \\ a\ ^2P \quad a\ ^2D \quad\quad a\ ^2G \quad a\ ^2H \end{cases}$		
	ns ($n \geq 4$)	*np* ($n \geq 4$)	*nd* ($n \geq 4$)
$3d^2(a\ ^3F)nx$	$\begin{cases} b\ ^4F \\ b\ ^2F \end{cases}$	$z\ ^4D° \quad z\ ^4F° \quad z\ ^4G°$ $z\ ^2D° \quad z\ ^2F° \quad z\ ^2G°$	$e\ ^4H$

*For predicted terms in the spectra of the Sc I isoelectronic sequence, see Introduction.

V IV

(Ca I sequence; 20 electrons) $\qquad$ $Z=23$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^2\,{}^3F_2$

$a\,{}^3F_2$ 391000 cm^{-1} $\qquad$ I. P. 48 volts

White has classified 64 lines in the region between 675 A and 2269 A, and extrapolated the limit from isoelectronic sequence data. The limit derived from his ionization potential is entered in brackets in the table.

From a study of related spectra, Edlén has rejected White's $3d\,{}^1S_0$ term, and his four intersystem combinations. Edlén suggests that the line observed at 734.36 A (136173 cm^{-1}) may be designated a $a\,{}^1D_2 - z\,{}^3F_2^\circ$, which decreases White's singlet terms by 698 cm^{-1}. This change has been adopted here.

REFERENCE

H. E. White, Phys. Rev. **33**, 538 (1929). (I P) (T) (C L)
B. Edlén- unpublished material (Feb. 1949). (T) (C L)

V IV

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3d^2$	$a\,{}^3F$	2	0	318	$3d(^2D)4p$	$z\,{}^3F^\circ$	2	147133	520
		3	318	412			3	147653	712
		4	730				4	148365	
$3d^2$	$a\,{}^1D$	2	10960		$3d(^2D)4p$	$z\,{}^3P^\circ$	0	151446	−22
$3d^2$	$a\,{}^3P$	0	13121	117			1	151424	140
		1	13238	215			2	151564	
		2	13453		$3d(^2D)4p$	$z\,{}^1F^\circ$	3	153920	
$3d^2$	$a\,{}^1G$	4	18389		$3d(^2D)4p$	$z\,{}^1P^\circ$	1	155567	
$3d(^2D)4s$	$a\,{}^3D$	1	96195	215	$3d(^2D)4d$	$e\,{}^3G$	3	217835	262
		2	96410	385			4	218097	364
		3	96795				5	218461	
$3d(^2D)4s$	$b\,{}^1D$	2	100204		$3d(^2D)4d$	$e\,{}^3F$	2	223510	323
$3d(^2D)4p$	$z\,{}^1D^\circ$	0	144276				3	223833	430
							4	224263	
$3d(^2D)4p$	$z\,{}^3D^\circ$	1	146116	310	--------	------	---	---------	
		2	146426	425	V v ($^2D_{1\frac{1}{2}}$)	Limit	---	[391000]	
		3	146851						

Feb. 1949.

V IV Observed Terms*

Config. $1s^2\,2s^2\,2p^6\,3s^2\,3p^6+$	Observed Terms		
$3d^2$	$\{$ $a\,{}^3P$ $\qquad$ $a\,{}^3F$ $a\,{}^1D$ $\qquad$ $a\,{}^1G$		
	$ns\ (n\geq4)$	$np\ (n\geq4)$	$nd\ (n\geq4)$
$3d(^2D)nx$	$\{$ $a\,{}^3D$ $b\,{}^1D$	$z\,{}^3P^\circ$ $\quad$ $z\,{}^3D^\circ$ $\quad$ $z\,{}^3F^\circ$ $z\,{}^1P^\circ$ $\quad$ $z\,{}^1D^\circ$ $\quad$ $z\,{}^1F^\circ$	$e\,{}^3F$ $\quad$ $e\,{}^3G$

*A chart of predicted terms in the spectra of the Ca I isoelectronic sequence is given in the Introduction. Owing to the change in binding energies of the $3d$ and $4s$ electrons along this sequence, the arrangement of the charts of observed and predicted terms is not identical. In V IV the prefixes $a, b, \ldots e, z$ replace those indicating the running electron.

V v

(K I sequence; 19 electrons)   Z=23

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d\ ^2D_{1\frac{1}{2}}$

$3d\ ^2D_{1\frac{1}{2}}$ 526000 cm^{-1} I. P. 65.2 volts

The terms have been calculated from the data published by Gibbs and White, who classified 11 lines in the region between 286 A and 1716 A. From these data Kruger and Weissberg have calculated the limit by fitting a Ritz-Rydberg formula to the ^2S terms. Their limit in round numbers is quoted here.

REFERENCES

R. C. Gibbs and H. E. White, Phys. Rev. **33,** 162 (1929). (C L)
P. G. Kruger and S. G. Weissberg, Phys. Rev. **52,** 317 (1937). (I P)

V v

Config.	Desig.	J	Level	Interval
$3p^6(^1S)3d$	$3d\ ^2D$	$1\frac{1}{2}$ $2\frac{1}{2}$	0 620	620
$3p^6(^1S)4s$	$4s\ ^2S$	$\frac{1}{2}$	148100	
$3p^6(^1S)4p$	$4p\ ^2P°$	$\frac{1}{2}$ $1\frac{1}{2}$	*206347* *207617*	1270
$3p^6(^1S)5s$	$5s\ ^2S$	$\frac{1}{2}$	328167	
$3p^6(^1S)4f$	$4f\ ^2F°$	$\left\{\begin{array}{c}2\frac{1}{2}\\3\frac{1}{2}\end{array}\right\}$	*349204*	
$3p^6(^1S)6s$	$6s\ ^2S$	$\frac{1}{2}$	403933	
----------	------	---	---------	
V VI ($^1S_0$)	*Limit*	---	**526000**	

May 1948.

V VI

(A I sequence; 18 electrons)   Z=23

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ ^1S_0$

$3p^6\ ^1S_0$ 1040100 cm^{-1} I. P. 128.9 volts

Four lines are classified in the region between 128 A and 182 A, as combinations with the ground term. The values listed in the table have been rounded off in the last places.

For convenience, the Paschen notation has been added by the writer in column one under the heading "A I". As for A I, the jl-coupling notation in the general form suggested by Racah is here introduced, although LS-designations, as indicated in column two under the heading "Authors", are perhaps preferable for the terms thus far identified.

REFERENCES

P. G. Kruger and S. G. Weissberg, Phys. Rev. **48,** 659 (1935). (I P) (T) (C L)
P. G. Kruger, S. G. Weissberg and L. W. Phillips, Phys. Rev. **51,** 1090 (1937). (I P) (T)
G. Racah, Phys. Rev. **61,** 537 (L) (1942).

V VI

A I	Authors	Config.	Desig.	J	Level
$1p_0$	$3p^6$ ^{1}S	$3p^6$	$3p^6$ ^{1}S	0	0
$1s_4$	$3p^5$ $4s$ ^{3}P°	$3p^5(^2P^o_{1\frac{1}{2}})4s$	$4s$ $[1\frac{1}{2}]°$	2 1	 549300
$1s_2$	$3p^5$ $4s$ ^{1}P°	$3p^5(^2P^o_{\frac{1}{2}})4s$	$4s'[$ $\frac{1}{2}]°$	0 1	 557650
$2s_4$	$3p^5$ $5s$ ^{3}P°	$3p^5(^2P^o_{1\frac{1}{2}})5s$	$5s$ $[1\frac{1}{2}]°$	2 1	 771760
$2s_2$	$3p^5$ $5s$ ^{1}P°	$3p^5(^2P^o_{\frac{1}{2}})5s$	$5s'[$ $\frac{1}{2}]°$	0 1	 778920
		----------	-----	---	------
		V VII $(^2P^o_{1\frac{1}{2}})$	*Limit*	---	1040100
		V VII $(^2P^o_{\frac{1}{2}})$	*Limit*	---	1047760

May 1948.

V VII

(Cl I sequence; 17 electrons) $Z=23$

Ground state $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^5$ $^2P^o_{1\frac{1}{2}}$

$3p^5$ $^2P^o_{1\frac{1}{2}}$ *1216000* cm^{-1} I. P. 151 volts

All of the terms except $3p^6$ ^{2}S are from the paper by Edlén. Thirteen lines in the region between 148 A and 472 A have been classified as combinations from the ground state. Edlén has estimated the value of the limit by extrapolation along the isoelectronic sequence, as indicated by brackets in the table. His unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCES

S. G. Weissberg and P. G. Kruger, Phys. Rev. **49**, 872 (A) (1936). (C L)
B. Edlén, Zeit. Phys. **104**, 407 (1937). (I P) (T) (C L)

V VII

Config.	Desig.	J	Level	Interval
$3s^2$ $3p^5$	$3p^5$ ^{2}P°	$1\frac{1}{2}$ $\frac{1}{2}$	*0* *7660*	-7660
$3s$ $3p^6$	$3p^6$ ^{2}S	$\frac{1}{2}$	219160	
$3s^2$ $3p^4(^3P)4s$	$4s$ ^{4}P	$2\frac{1}{2}$ $1\frac{1}{2}$ $\frac{1}{2}$	608640 612810 615480	 -4170 -2670
$3s^2$ $3p^4(^3P)4s$	$4s$ ^{2}P	$1\frac{1}{2}$ $\frac{1}{2}$	620650 625570	-4920
$3s^2$ $3p^4(^1D)4s$	$4s'$ ^{2}D	$2\frac{1}{2}$ $1\frac{1}{2}$	638540 638710	-170
$3s^2$ $3p^4(^1S)4s$	$4s''$ ^{2}S	$\frac{1}{2}$	671580	
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V VIII $(^3P_2)$	*Limit*	---	*[1216000]*	

January 1948.

V VIII

(S I sequence; 16 electrons) $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4\ {}^3P_2$

$3p^4\ {}^3P_2$ 1401000 cm^{-1} I. P. 173.7 volts

The analysis is by Edlén, who has classified 19 lines in the range between 135 A and 147 A. He has extrapolated the limit from isoelectronic sequence data. The singlet and triplet terms are connected by two observed intersystem combinations.

Edlén's unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **104**, 188 (1937).   (I P) (T) (C L)

V VIII   V VIII

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
$3s^2\ 3p^4$	$3p^4\ {}^3P$	2	0	-6000					
		1	6000	-1580	$3s^2\ 3p^3({}^2D^\circ)4s$	$4s'\ {}^1D^\circ$	2	*718450*	
		0	7580		$3s^2\ 3p^3({}^2P^\circ)4s$	$4s''\ {}^3P^\circ$	0	*734246*	
$3s^2\ 3p^4$	$3p^4\ {}^1D$	2	27120				1	*734870*	630
							2	*736640*	1770
$3s^2\ 3p^4$	$3p^4\ {}^1S$	0	60720		$3s^2\ 3p^3({}^2P^\circ)4s$	$4s''\ {}^1P^\circ$	1	*742790*	
$3s^2\ 3p^3({}^4S^\circ)4s$	$4s\ {}^3S^\circ$	1	*687250*						
$3s^2\ 3p^3({}^2D^\circ)4s$	$4s'\ {}^3D^\circ$	1	*710600*	310	V IX $({}^4S_{1\frac{1}{2}})$	*Limit*	---	**1401000**	
		2	*710910*	1080					
		3	*711990*						

January 1948.

V IX

(P I sequence; 15 electrons) $Z=23$

Ground state $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3\ {}^4S^\circ_{1\frac{1}{2}}$

$3p^3\ {}^4S^\circ_{1\frac{1}{2}}$ cm^{-1} I. P.   volts

Kruger and Pattin have observed 6 lines near 126 A, and arranged them in two multiplets that give intervals consistent with those found in related isoelectronic spectra.

By a rough extrapolation of $3p^3\ {}^4S^\circ_{1\frac{1}{2}} - 3p^3\ {}^2D^\circ_{1\frac{1}{2}}$ along the isoelectronic sequence, the writer has estimated the value of $3p^3\ {}^2D^\circ_{1\frac{1}{2}}$ (entered in brackets in the table), and calculated the terms listed below from the multiplets given by Kruger and Pattin. The uncertainty x in the estimated position of the doublet terms relative to the quartets may exceed ± 500 cm^{-1}.

REFERENCE

P. G. Kruger and H. S. Pattin, Phys. Rev. **52**, 624 (1937).   (C L)

V IX

Config.	Desig.	J	Level	Interval
$3s^2\,3p^3$	$3p^3\ {}^4S^\circ$	$1\frac{1}{2}$	0	
$3s^2\,3p^3$	$3p^3\ {}^2D^\circ$	$1\frac{1}{2}$ $2\frac{1}{2}$	$[36000]+x$ $37520+x$	1520
$3s^2\,3p^2({}^3P)4s$	$4s\ {}^4P$	$\frac{1}{2}$ $1\frac{1}{2}$ $2\frac{1}{2}$	789070 792700 797320	3630 4620
$3s^2\,3p^2({}^1D)4s$	$4s'\ {}^2D$	$2\frac{1}{2}$ $1\frac{1}{2}$	$824500+x$ $824860+x$	-360

December 1947.

V XI

(Al I sequence; 13 electrons) $Z=23$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\,3p\ {}^2P_{\frac{1}{2}}$

$3p\ {}^2P^\circ_{\frac{1}{2}}$ cm^{-1} I. P.   volts

This spectrum has not been analyzed, but Edlén has classified two lines as follows:

I. A.	Int.	Wave No.	Desig.
87. 166 87. 868	3 4	1147240 1138070	$\}3p\ {}^2P^\circ - 4d\ {}^2D$

His unit, 10^3 cm^{-1}, is here changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **103**, 540 (1936).   (C L)

December 1947.

V XII

(Mg I sequence; 12 electrons) $Z=23$

Ground state $1s^2\,2s^2\,2p^6\,3s^2\ {}^1S_0$

$3s^2\ {}^1S_0$ **2490000** cm^{-1} I. P. 309 volts

Edlén has classified 15 lines in the region between 61 A and 106 A.   No intersystem combinations have been observed, and the triplet terms are not all connected by observed combinations.   He has determined the relative positions of the various groups of terms and also the ionization potential by extrapolation along the isoelectronic sequence.   His estimated value of the limit is entered in brackets in the table.

His unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

REFERENCE

B. Edlén, Zeit. Phys. **103**, 536 (1936).   (I P) (T) (C L)

<center>V XII   V XII</center>

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
3s²	3s² ¹S	0	0		3s(²S)4f	4f ³F°	2		
3s(²S)3p	3p ³P°	0	188350+x	3100			3		
		1	191450+x	7160			4	1485160+x	
		2	198610+x		3s(²S)5d	5d ²D	1		250
3s(²S)3d	3d ³D	1					2	1818660+x	
		2					3	1818910+x	
		3	549580+x		3s(²S)5f	5f ³F°	2		
3s(²S)4s	4s ³S	1	1212500+x				3		
3s(²S)4p	4p ¹P°	1	1310500				4	1848960+x	
3s(²S)4d	4d ³D	1	1424530+x	320	------------	------	---	---------	
		2	1424850+x	560	V xiii (²S½)	Limit	---	[2490000]	
		3	1425410+x						

August 1947.

<center>V XIII</center>

<center>(Na I sequence; 11 electrons)   Z=23</center>

Ground state $1s^2\,2s^2\,2p^6\,3s\,{}^2S_{\frac{1}{2}}$

$3s\,{}^2S_{\frac{1}{2}}$ **2713130** cm⁻¹   I. P. 336.29 volts

Edlén has classified 15 lines in the interval 52 A to 99 A, and extrapolated the absolute value of the ground term from isoelectronic sequence data.

The unit adopted by Edlén, 10³ cm⁻¹, has here been changed to cm⁻¹.

<center>REFERENCE</center>

B. Edlén, Zeit. Phys. **100**, 621 (1936). (I P) (T) (C L)

<center>V XIII   V XIII</center>

Config.	Desig.	J	Level	Interval	Config.	Desig.	J	Level	Interval
3s	3s ²S	½	0		4f	4f ²F°	2½	1550290	220
3p	3p ²P°	½	225350	11080			3½	1550510	
		1½	236430		5p	5p ²P°	½	1889360	2070
3d	3d ²D	1½	545500	1230			1½	1891430	
		2½	546730		5d	5d ²D	1½	1946050	310
4s	4s ²S	½	1300330				2½	1946360	
4p	4p ²P°	½	1388410	4370	5f	5f ²F°	2½	1968740	
		1½	1392780				3½		
4d	4d ²D	1½	1505740	600	------------	------	---	---------	
		2½	1506340		V xiv (¹S₀)	Limit	---	2713130	

June 1947.

V XIV

(Ne I sequence; 10 electrons) $Z=23$

Ground state $1s^2\,2s^2\,2p^6\ {}^1S_0$

$2p^6\ {}^1S_0$ **7237600** cm^{-1} I. P. 897.1 volts

Edlén and Tyrén have classified four lines in the region between 20 A and 23 A, as combinations with the ground term. They have derived absolute term values by extrapolation along the Ne I isoelectronic sequence. Their unit, 10^3 cm^{-1}, has here been changed to cm^{-1}.

As for Ne I, the jl-coupling notation in the general form suggested by Racah is introduced.

<div align="center">REFERENCES</div>

B. Edlén and F. Tyrén, Zeit. Phys. **101**, 210 (1936). (I P) (T) (C L).
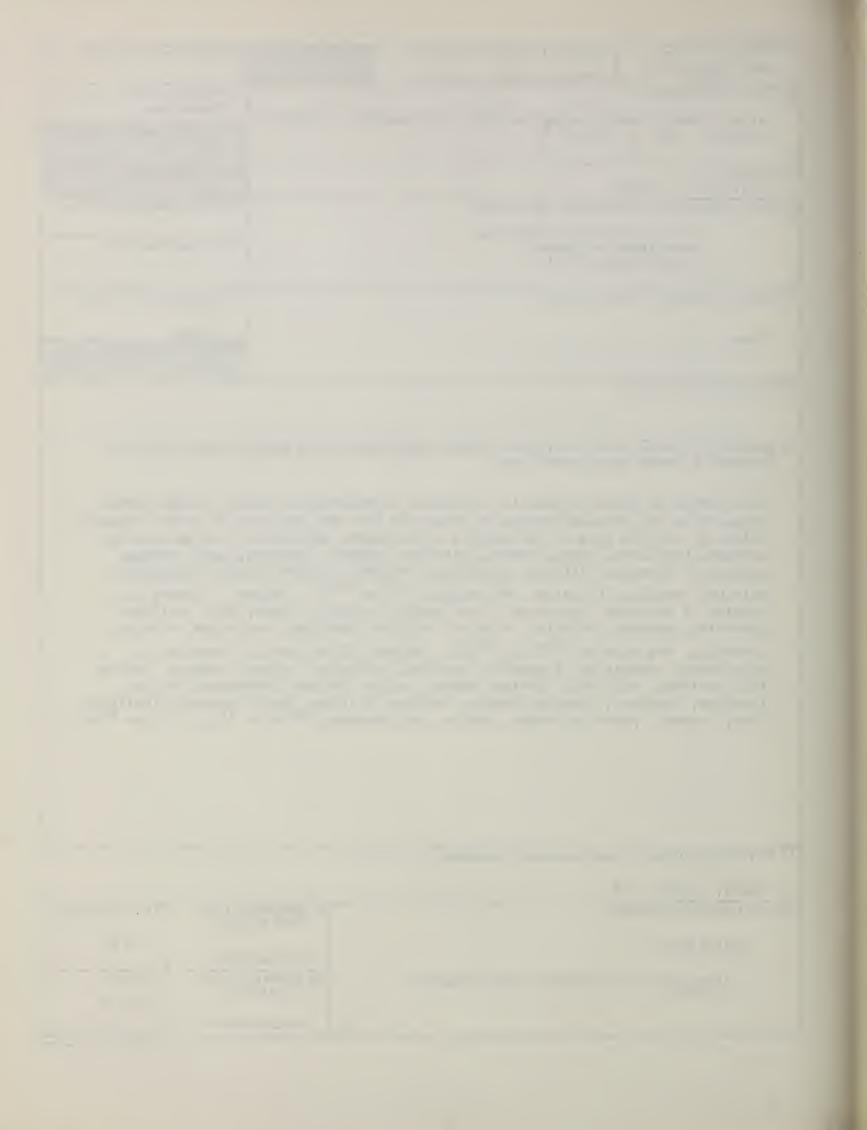G. Racah, Phys. Rev. **61**, 537 (L) (1942).

<div align="center">V XIV</div>

Authors	Config.	Desig.	J	Level
$2p\ {}^1S_0$	$2p^6$	$2p^6\ {}^1S$	0	0
$3s\ {}^3P_1$	$2p^5({}^2P^o_{1\frac{1}{2}})\,3s$	$3s\ [1\frac{1}{2}]^o$	2 1	*4202700*
$3s\ {}^1P_1$	$2p^5({}^2P^o_{\frac{1}{2}})\,3s$	$3s'[\ \frac{1}{2}]^o$	0 1	*4257100*
$3d\ {}^1P_1$	$2p^5({}^2P^o_{1\frac{1}{2}})\,3d$	$3d\ [1\frac{1}{2}]^o$	1	*4757800*
$3d\ {}^3D_1$	$2p^5({}^2P^o_{1\frac{1}{2}})\,3d$	$3d'[1\frac{1}{2}]^o$	1	*4827200*
	------------	------	---	-------
	V xv $({}^2P^o_{1\frac{1}{2}})$	*Limit*	---	**7237600**
	V xv $({}^2P^o_{\frac{1}{2}})$	*Limit*	---	7295300

April 1947.

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15. SUPPLEMENTARY NOTES

16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

This series of three volumes is a critical compilation of atomic energy levels prepared at the National Bureau of Standards from the analyses of optical spectra. Volume I contains data on the spectra of hydrogen, deuterium, tritium, helium, lithium, beryllium, boron, carbon, nitrogen, oxygen, fluorine, neon, sodium, magnesium, aluminum, silicon, phosphorus, sulfur, chlorine, argon, potassium, calcium, scandium, titanium, and vanadium (^{1}H to ^{23}V). Volume II covers the spectra of chromium, manganese, iron, cobalt, nickel, copper, zinc, gallium, germanium, arsenic, selenium, bromine, krypton, rubidium, strontium, yttrium, zirconium, and niobium (^{24}Cr to ^{41}Nb). Volume III includes the spectra of molybdenum, technetium, ruthenium, rhodium, palladium, silver, cadmium, indium, tin, antimony, tellurium, iodine, xenon, cesium, barium, lanthanum; hafnium, tantalum, tungsten, rhenium, osmium, iridium, platinum, gold, mercury, thallium, lead, bismuth, polonium, radon, radium, and actinium (^{42}Mo to ^{57}La; ^{72}Hf to ^{89}Ac).

17. KEY WORDS (Alphabetical order, separated by semicolons)

Energy levels; H-V.

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